Sami Tauru

Water: the Fuel of Economy

Global Water Industry as an Investment Opportunity

Metropolia University of Applied Sciences

Bachelor of Business Administration

Finance and Accounting

Bachelor's Thesis

May 2017

Metropolia

Tekijä Otsikko Sivumäärä Aika	Sami Tauru Vesi: Talouden polttoaine Vesi sijoituskohteena 68 sivua + 1 liite toukokuu 2017
Tutkinto	Tradenomi
Koulutusohjelma	Liiketalous
Suuntautumisvaihtoehto	Laskentatoimi ja rahoitus
Ohjaaja	Lehtori Antti Hovi

Tämän opinnäytetyön tarkoitus oli määritellä kokonaisvaltaisella tavalla globaali vesiteollisuus ja sen sektorit sekä summata tulevaisuuden kasvuodotuksia. Lisäksi opinnäytetyön tarkoitus tutkia vesiteollisuuteen sijoittaneiden indeksiosuusrahastojen (ETF) historiallista suoriutumista verrattuna koko markkinoihin sekä valittuun vertailuindeksiin.

Opinnäytteen ensimmäinen osio toteutettiin laadullisella tutkimusmenetelmällä tutkimalla raportteja, artikkeleita sekä akateemisia lähteitä. Opinnäytteessä pyrittiin löytämään yhteisiä ryhmittelyitä, kunnes uutta tietoa ei enää löydy, ja tiivistämään löydetyt luokittelut. Tutkimuksen toinen osio tehtiin määrällisenä tutkimuksena, jossa analysoitiin rahastojen historiallista hintadataa laskemalla tunnuslukuja ja analysoimalla tuloksia. Koko markkinoiden edustajana käytettiin Standard & Poor’sin 500 -indeksiä ja vertailuindeksinä käytettiin Standard &Poor’sin ruoka ja juoma -indeksiä.

Tutkimuksessa tutkittiin neljää Yhdysvaltoihin listattua rahastoa, ja tutkimustulokset osoittivat, että vain yksi rahastoista onnistui voittamaan kokonaismarkkinat ja Capital Asset Pricing -mallin mukaisen tuotto-odotuksen. Kaikki tutkitut rahastot hävisivät kuitenkin vertailuindeksille. Loput rahastoista hävisivät sekä kokonaismarkkinoille että vertailuindeksille. Yhden rahaston tuotto oli tutkimusjakson lopulla negatiivinen.

Avainsanat	vesiteollisuus, ETF, vesi, indeksiosuusrahasto, sijoittaminen

Author Title Number of Pages Date	Sami Tauru Water: the Fuel of Economy Water as an Investment Opportunity 68 pages + 1 appendix May 2017
Degree	Bachelor of Business Administration
Degree Programme	Economics and Business Administration
Specialisation option	Finance and Accounting
Instructor	Antti Hovi, Senior Lecturer

The purpose of the thesis was to define in a holistic way the global water industry, the sub-sectors it includes and to summarize the growth expectations of the industry. Also, the purpose of the thesis was to study the historical performance of the Exchange-traded Funds (ETF) that invest in the water industry, and to compare their performance to overall markets and to the selected benchmark industry.

The first part of the thesis followed qualitative approach by using various reports, articles and academic sources as a research material. The study aimed to find common definitions of water industry to point of saturation, until no new information was found, and to summon the most common definitions. The second part of the thesis followed quantitative approach by analyzing the historical price data of the selected funds by calculating key figures from the historical price data and by analyzing the results. As the representative of overall markets, the Standard & Poor's 500 -index was used, and as the chosen benchmark index, the Standard & Poor's Food and Beverage -Index was used.

Four funds listed in United States Stock Exchange were studied in the thesis and the result showed that only one fund out of four manage to over-perform the overall markets and the Capital Asset Pricing Model expectations, but lost to the bench mark industry. Rest of the funds under-performed compared to the overall markets and to the benchmark industry. At the end of the study, one of the funds had negative performance.

Keywords	water industry, ETF, water, investing

Content

Attachments

Attachment 1.

Historical price index development of overall markets, studied funds and benchmark index.

1 Introduction

1.1 Choosing the Topic

The subject of this thesis is the global water industry and Exchange-traded Funds (ETF) that invest in the water industry. The thesis approaches the topic from the perspective of a small investor. The choice for the topic of the thesis was strongly influenced by the author's personal interest towards water industry, the business opportunities it includes and ETFs as an investment instrument.

My interest toward water industry began when our lecturer of marketing wanted to sharpen us students, that we need to know our customers and there is no industry where *everyone* is your customer. Our lecturer promised to give five extra points for he or she, who could point out even one industry or sector where *everyone* would be a customer. She also mentioned that no one had ever caught those famous five extra points.

After two weeks of a hard thinking to earn those extra credits (and to out-smart my teacher), my best suggestion for that industry where everyone could be your customer was the water sector: My leading argument was that from developed countries to developing countries, everyone pays for their water one way or the other. I also argued that the customership lasts a lifetime and there is no substitute for water. And those are just the private users. Industry and agriculture are cases of their own.

I don't remember if I got those five extra credits or not, but I do remember, that at that moment I had found my passion.

My interest towards ETFs comes strongly from my personal interest toward investing. As a future private investor, I am interested in proper diversification, low costs (by keeping in mind Warren Buffet's "100 billion mistake") and simplicity. To all of these, the ETFs seem to be the most suitable and simplest solution, so why not combine these two, learn more about both topics and make my thesis about them.

1.2 Structure of the Thesis

The thesis is divided into two parts. The first part of the thesis is more qualitative of its nature and it aims to map out the current state of global water demand and supply. It also aims to describe the global water industry and the key factors and trends that influence to water industry and to the water consumption. This part of the thesis includes also the growth predictions of the water industry.

The second part of the thesis is quantitative part of the thesis. This part is based on statistics and numerical analyses of the funds that invest in the companies that operate in the water sector. In this part key figures are calculated based on available numerical information and the results of key figure are analyzed. At the end of the thesis, there is conclusion where the results are analyzed and the research questions are being answered.

1.3 The Purpose of the Thesis

The purpose of the first part of the thesis is to provide overall and holistic understanding of the current state of the global demand and supply of water and to demonstrate the economic value of clean water and how the water-related issues are closely linked to economy. The purpose is also to introduce for the reader in overall and general level what is water industry and what kind of sectors it includes.

The thesis will also summarize the existing growth expectations for water industry. This is done by introducing global megatrends such as climate change, population growth and urbanization to describe what kind of opportunities lies in these challenges. The approach is that where these trends include challenges, they also include opportunities for industrial development and economic growth.

Because the analysis is done globally and about global markets, the qualitative research is done on a general level, and deep sector specific analysis is not included. The perspective of the thesis is narrowed mainly to economic approach because both of the humanistic and environmental aspects of the global water issues are already very well covered.

The purpose of the second part of the thesis is to briefly introduce for the reader exchange-traded funds and what kind of investment instrument they are. Secondly, the purpose is to calculate the historical performance of the selected ETF's on chosen period of time to reflect the performance of the water industry and to compare it to the performance of overall markets and to the selected benchmark industry. The introduction of the ETF as an investment instrument is done from the perspective of small investor's point of view and from the assumption, that the investor knows nothing about the investment instrument.

The second part of the thesis will study the historical performance of the funds that invest in the water industry. These returns represent the historical profits of the water industry. The returns are compared to the overall development of global markets and to the benchmark industry. As a representative for global markets to compare with the Standard and Poor's 500 (SPX) -index is chosen. As Benchmark industry, the food industry is chosen.

The thesis is narrowed to study only the performance of the ETF's listed in either New York Stock Exchange or in NASDAQ. This decision is done because these markets represent the biggest and most efficient markets in the world. As the representation of the overall markets the S&P 500 is chosen because it covers widely enough the economic development of different industrial sectors in U.S.

S&P 500 is also one of the oldest indexes in the world and it has one of the longest continuous history data available in the world. Also, by limiting the ETF's in these two markets, all the selected funds will be listed in the same currency and no currency exchange rate corrections need to be done. This will simplify the research and serve the purpose of the thesis.

As representative of food industry, the S&P Food & Beverage Select Industry Index (SPSIFB) is chosen. The benchmarking of the water industry is very difficult because the water industry includes various different sectors and the companies that operate in the field of "water industry" may focus on producing very different kind of products and services. The leading argument for benchmarking to food industry was to find something as fundamental for human survival to benchmark with as the water is. Nonetheless, this covers only one aspect of the water consumption and it is difficult to determine what industry or sector should be used as a benchmark.

1.4 The Research Questions

The qualitative part of the thesis will give the reader the overall understanding about current demand and supply of fresh water, summarize the water industry and introduce the key sectors of the industry. The first part will also summarize some of the future prospects of the water industry. The key research questions are introduced bellow.

- What is the current status of world's water demand and supply?
- How can be the water industry described or defined?
- What kind of sectors does the water industry include?
- What are the future growth predictions of water industry?

The second part of the thesis will study the historical performance of the funds that invest in the water industry. These returns represent the historical profits of the water industry. The returns are compared to the overall development of global markets and to the benchmark industry. The key research questions of the quantitative part of the thesis are introduced bellow.

- How have the funds that invest in water industry performed historically?
- How have the funds performed compared to overall markets?
- How have the funds performed compared to benchmark industry?
- How volatile are the returns of the water industry?

1.5 Selection of the Funds

The criteria to narrowing the research material and to select ETF's for this research are the following:

- Selected fund must be classified as an ETF (Exchange-Traded Fund)
- The fund must follow water related or water specific index.
- The fund must be listed and traded in either in the New York Stock exchange or in the NASDAQ Stock Market
- The ETF must be listed at least in U.S. dollars
- Must be registered and active as per 15.6.2007
- The fund must have continuous price data available from NYSE, NASDAQ or other trusted resource since 15.6.2007

- The fund must invest 90 per cent of its assets to either stocks or other assets classes excluding cash.

From NYSE and NASDAQ, totally five funds were founded that invest in the water industry. From these five funds four matched to all of the research criteria and all of them were selected as a subject for study. The selected funds are

- Guggenheim S&P Global Water ETF (CGW)
- First Trust ISE Water ETF (FIW)
- PowerShares Water Resources ETF (PHO)
- PowerShares Global Water ETF (PIO)

1.6 Previous Studies

Vast amount of news, articles and research papers have been published about the global water crises by academic journals and magazines. In most of these publications the perspective is strongly either humanitarian or environmental. Also most of the bachelor's thesis found n Theseus, the database of all electronic theses of universities of applied sciences in Finland, focus on water related issues either from humanitarian, environmental or technical perspective.

The economic and business orientated point of view for water issues is covered only by few theses. All of these theses are commissioned by a company and cover only very specific markets and business opportunities or business problems. Therefore neither holistic overview of the water industry seems to exist nor a summary of growth expectations of the industry.

1.7 Research Material and Research Methods

For this thesis, the research material for the analyses is collected from great number of different sources. For the qualitative part of the study, the material is collected from articles, online publications, academic journals, and official websites. The research material is collected from various sources that are considered as reliable and adequate. In the analysis, the technique of saturation is used. The research material is studied through and searched for definitions of water industry and sector distribution.

The most common definitions of water industry and sector distribution are selected as a definition of water industry. The research is completed when the same definitions and sector distributions are emerging and no new relevant information is found.

For the quantitative part of the study, the historical price data of the studied funds and indexes used as a bench mark is retrieved, and from the numerical data, the key selected figures are calculated and the results of calculated figures are analyzed. Data and statistics are retrieved from databases which are specialized in financial and economic data and considered as a reliable. Main source for this economic data will be the New York Stock Exchange and NASDAQ where the price history of the funds is retrieved.

From the historical price data, the historical performance of the ETFs, overall markets and the food industry is calculated for period of 1, 3, 5 and 9 years. The period of nine years represent the longest period of time when price data is available for both selected ETFs and bench mark index.

From the historical price data, the historical volatility of the ETFs, overall markets and food industry is also calculated. Because the volatility is calculated from historical price data, volatility equals as the standard deviation of the fund price. Existing data is used, when available and the data is in a suitable form for thesis. Also, the Beta values of the ETFs are calculated to define the reactivity of the water industry compared to the overall markets and bench mark industry.

Tracking error of the water ETFs compared to their benchmark index is excluded from the research. It is assumed that usual tracking error exist when investing passively in specific sector of industry. It is also assumed that the ETFs investing in the water industry have same distribution in their performance as when investing in any other industry or sector.

In the numerical research, the key figures and historical performances are calculated from the orginal price data. In the visual presentation of the historical performance of the study subjects (Attachment 1), the historical price data of the ETFs, overall markets and food industry is set to start from 100 index points to make it easier to compare the performance and development of the ETFs, overall markets and the food industry between each other.

The expected Capital Asset Prizing Model (CAPM) returns are calculated for the ETF funds and for the Food and Beverage index. In CAPM calculations, the self-calculated beta is used, because different sources, such as NYSE, Yahoo Finance, Google Finance and the fact sheets of the funds, announce different Betas for same fund. This might occur due usage of different time periods or calculation methods in the beta calculations.

2 Theoretical Framework

The most essential theories and concepts in this thesis are introduced in the chapters of theoretical framework. The most important theories focus on measuring the risk and the return of and investment. The theories also pay close attention on measuring the achieved return per taken unit of risk. The chapters will briefly introduce Modern Portfolio Theory (MPT), Capital Asset Pricing Model (CAPM), Beta value, Sharpe's ratio and R-squared. All of the theories mentioned earlier are adequate when investing in investment vehicles such as ETFs.

2.1 Modern Portfolio Theory

2.1.1 Fundamental Idea

The purpose of all economic activity is to produce profit. Traditionally, the profit or the return of the investment is defined as the positive change in the value of the investment and all underlying assets during a specific chosen period of time. The performance is traditionally expressed in the form of percentage. When measured in percentage, it is easy to compare the return of different type of investments together. (Puttonen & Repo 2007, 81-83.)

All investing activity also involves a risk. The risk can be defined as an uncertainty of the future returns and as a possibility that the actual return of the investment differs from the expected return. Technically, the risk can have also a positive outcome, but usually when considering the risk it is focused on the unexpected negative outcome of the risk. Economic theories summarize the relation of risk and return as followed; High-

er the risk of the investment is the higher is the expected compensation for the risk should be. (Puttonen & Repo 2007, 84-88.)

Modern Portfolio theory is an investment theory which focuses on portfolio efficiency, diversification of the portfolio's investments and risk-avoidance. The purpose of the theory is to define and present risk in mathematical form and thereby maximize the return of an investment at the selected level of risk. The theory is developed by Harry Markowitz in 1952. The theory was first introduced in his seminal publication "Portfolio Selection". (Elton & Gruber 1997, 1743-1759.)

The basic idea of the theory is, that when building an optimal investment portfolio, investors should not only focus on the characteristics of the individual securities, but the correlation between all of the securities and to select securities that correlate together as little as possible, or even having a negative correlation. (Khan & Jain 2007, 3.10) This way, optimal portfolio can be accomplished, and the risk can be minimized on selected level of profit, or vice versa, the profit can be maximized on selected level of risk. In his theory, Markowitz divides the risk of investing into two categories: To systematic risk and to non-systematic risk. (Elton & Gruber 1997, 1743-1759.)

2.1.2 Systematic Risk

The purpose of proper diversification of the portfolio is to remove the non-systematic risk from the portfolio and to reduce the systematic risk as low as possible. The Systematic risk, or market risk, is the type of risk that influence to all markets and to all assets and investment products. The market risk is also unpredictable and unavoidable. Examples of this kind of unpredictable risks that influence the all markets are terrorist attacks of September eleven or the recession of 2008. Because the systematic risk is unavoidable, it will be always present in portfolios and it cannot be fully diversified away. (Khan & Jain 2007, 3.10) Market risk also explains why different type of assets produce a different type of return; A higher return on assets associated with higher exposure to the market risk, and lower return for on assets with lower exposure. (Pandey 2015, 100.)

2.1.3 Diversification

According to the Modern Portfolio Theory, in the management of portfolio and management of the systematic risk one of the key elements is diversification. Diversification means allocating the invested assets between different type of asset classes and investment instruments by hoping that unpredictable market events influence in different way in different asset classes. This way, in theoretically, the portfolio could produce some profit in every market situation. Example of well diversified portfolio could include stocks, corporate or government bonds, options, futures, derivatives and plain cash. This example portfolio would experience smaller exposure to the unexpected market events, and therefore have smaller variance in risk and return profile, than for example portfolio that includes only stocks. The reduced risk rate of the example portfolio would be caused by the difference on how the prices of the bonds and stocks react to the unexpected market events. (Berk & DeMarzo 2014, 332.)

2.1.4 Non-systematic Risk

Along with market risk, every asset in the portfolio includes a specific risk that is related only to this specific asset. This risk can be described as the deviation of the assets return that is not related to the market risk. This asset specific risk is called non-systematic risk, company risk or business risk and it includes only the uncertain events on a firm scale. According to Modern Portfolio Theory, when the diversification of the portfolio is done properly, the asset-specific risk can be diversified away almost totally and therefore it is meaningless. This leads to conclusion that when several different securities are put together, the portfolio's overall risk will be the sum of its systematic risk within the market portfolio of risky assets. (Reilly & Brown 2011, 22.)

From Markowitz's theory it can be conducted that (in theory) all unsystematic risk of the portfolio can be diversified away without holding a large amount of assets. Instead of owning numerous securities, it should be focused on owning securities that have strong negative covariance. Covariance is a measure of the degree to which returns on two risky assets move in tandem. When covariance is positive figure, the asset returns move together. When the covariance is negative, the returns move inversely and if the covariance is zero, the return of the assets does not react on each other. (Investopedia: Covariance)

A theoretical portfolio that consist only two securities that have perfect negative correlation between each other has the potential to achieve level of zero risk. If we add more securities on this theoretical portfolio, the portfolio has the tendency to move closer and closer to the systematic risk. (Khan & Jain 2007, 3.9) In order to find the optimal portfolio and the covariance, by using the mean-variance theory, the investor needs to determine the mean and variance of every security in the portfolio. The mean-variance theory contains two components: Variance and the expected return. Variance represents how spread-out the data set numbers is for example in a form of the variability in daily or weekly returns of a selected security. The expected return is a subjective probability that need to be decided. (Investopedia: Mean-variance Analysis) Both mean and variance are used in the calculations on the correlations and covariance for all securities in the portfolio over a selected period of time. (Elton & Gruber 1997, 1743-1759.)

2.1.5 Efficient Frontier

The idea of the efficient frontier can be conducted from the modern portfolio theory. The modern portfolio theory argue that if expected returns, volatilities and the restrictions of the investment opportunities are given, it is possible to calculate the mean-variance optimization and to form the selection of most efficient investment portfolios. Those portfolios form the efficient frontier. Every portfolio that is located on the frontier graph is an optimal portfolio that yields the highest return on selected level of risk, or carries the lowest amount of risk in selected level of return. (Fabozzi, Gupta & Markowitz 2002, 7-22.)

In the figure below is illustrated the Efficient Frontier of risk-containing securities in relation with risk-return exchange. The individual assets which are not located on Efficient Frontier are underperforming compared to the chosen level of risk.

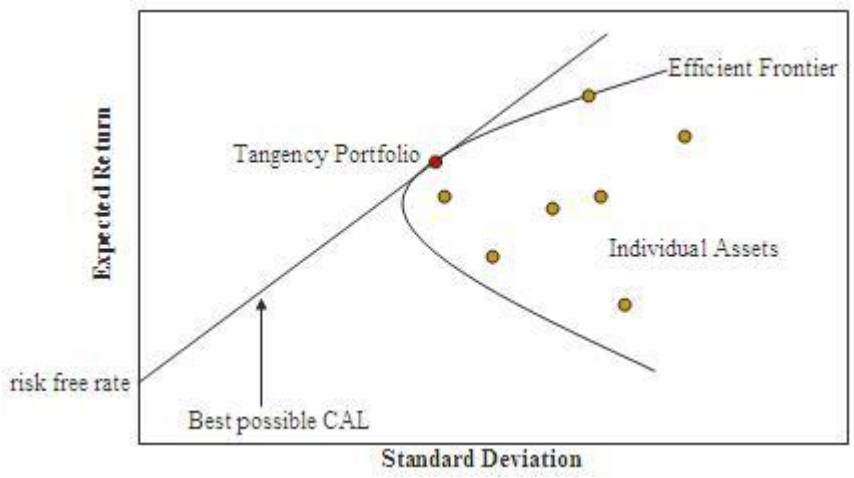

Figure 1. Efficient Frontier. Wikipedia

The frontier graph begins from the portfolio with minimum variance which is the most profitable portfolio with the least amount of risk. Theoretically, this would be portfolio containing only the risk-free interest rate. The frontier extends to the right while both risk and return increases in value. All portfolios that place below the graph of efficient frontier are inefficient portfolios because each sub-optimal portfolio holds more risk on selected level of return than needed. (Pandey 2015, 96-99.)

This means that in those portfolios it would be possible to maintain the same level of risk while accumulating higher returns. Theory also implies that because the efficient frontier contains all of the optimal portfolios, it is impossible to be placed sustainably above the efficient frontier in extended periods of time. When investor is forming his portfolio, investor needs to decide his/hers tolerance of risk to decide where to place the portfolio on the efficient frontier. (Pandey 2015, 96-99.)

2.2 Efficient Market Hypothesis

The Efficient Market Hypothesis (EHM) is developed by Professor Eugene Fama in 1960s. The Hypothesis argues that the prices of the stocks reflect all information available for the investors and therefore the share price represents its true value. The theory assumes that in efficient markets all investors act rationally and base their decisions

only on the available information about the markets and therefore there are no mispriced stocks. If all actors in the markets do not act rationally there might occur temporary mispricing of stock or stocks. Whenever this kind of mispricing has occurred, rational investors try to achieve benefit from this accrued mispricing and the markets will correct itself. Because of this self-correcting nature of the markets, it should not be possible to over perform the overall markets in the long run through stock selection. (Stotz, 261-275, Fama, 383-417)

2.3 Capital Asset Pricing Model

The capital Asset Pricing model (CAPM) is an economic model that aims to describe mathematically the relationship between risk and return of individual security and diversified portfolio. The model answers how much investor should be compensated of each taken unit of risk. The Model is based on the modern portfolio theory and it was developed independently and separately by four economics - Jack Treynor (Treynor 1962.), William Sharpe (Sharpe 1964, 425-442.)**,** John Litner (Litner 1965, 13-37) and Jan Mossin (Mossin 1966, 768-783). From these four, William Sharpe was awarded with Nobel Prize for his achievements in the field of economic science in 1990. (Sullivan 2006, 207-210.)

The capital asset pricing model has seven basic theoretical assumptions. Those assumptions are:

1. All investors are rational, avoid risk and try to achieve an efficient portfolio.
2. All investors aim to maximize the profit
3. All investors have homogenous expectation.
4. All information is available for everyone and only public securities are traded.
5. All investors can borrow and lend money at common risk-free rate.
6. All trade can be done without transaction costs or taxation.
7. All securities are endlessly divisible into small parcels. (theoretically Investor can invest to Google's stock with one dollar)

(Berk & DeMarzo 2014, 379-380.)

The CAP model moved the main focus of choosing the investment instrument into a portfolio from firm-specific volatility or standard deviation of individual instrument to the risk of chosen instruments correlation to the markets. In his unpublished paper Treynor (1962) divide the estimation of expected return of portfolio or security into two separate factors, the risk-free interest rate and the adjusted risk premium. (Frencha, 2003, 60-72.)

The risk-free interest rate of the market refers to the expected return of asset that holds no risk and should therefore have a negative correlation to all assets that include risk and also, if asset is considered as a truly risk-free, it must not hold any default risk or reinvestment risk. (Damodaran 2008, 2-9.) Under these terms and conditions, the only appropriate security for this risk-free measurement is the government-issued bonds that pay no interest during the period of research and therefore is free from reinvestment risk. (Damodaran 1999, 2-11)

The second component that influence to the CAPM is the risk premium of the investment. The risk premium of the investment can be described as the product of the investments beta (β) and the risk premium of the market, which is the market average return minus the risk-free interest rate. The risk premium determines what the expected excess return of risky security or portfolio over another risky investment should be. (Investopedia: Risk Premium)

By using the risk-free rate and the market return as a reference, the CAPM can hypothesize the performance of an investment and give the investments correlation with markets. Theory is supported by the empirical findings or Mr. Sharpe (1964) when he argued that investors should expect a higher return when investing in securities which have strong response to market volatility.

Mathematically, the Capital Asset Prizing formula is expressed:

$$E(R) = R_f + \beta(E(R_m) - R_f) \quad (1)$$

Where:

$E(R)$ is the expected return

β is the asset's market sensitivity

R_f is the risk-free interest rate

$E(R_m)$ is the expected market return

The Capital Asset Pricing model can be represented in a form of Security Market Line, where the risk-free asset holds Beta value of zero and portfolio containing all the securities available at the market holds beta value of one.

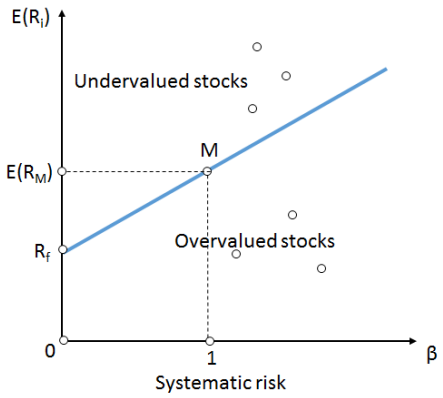

Figure 2. The CAPM pictured visually by using the Security Market Line (SML). Wikipedia

2.4 Beta

In the capital asset pricing model, the beta is defined as the volatility variable of the portfolio's undiversified risk in relation to all market. The beta act as a measure for that, how the portfolio response to market changes. If portfolio's beta is 1, the portfolio moves in tandem with the overall markets. This means that growth of 10 percent of the market growths the portfolio by 10 percent. If the portfolio's beta is higher than 1, that indicate that the volatility of the portfolio is stronger than the volatility of the market portfolio and the increase or decrease of the portfolio is greater than the market portfolio's return. If the portfolio's beta is below 1, that indicate the portfolio have a smaller reactivity on market changes than the overall markets have, and the increase or decrease

of the portfolio is not guaranteed, and may not react in same directions as the markets does. If portfolio's beta is zero, the portfolio has no correlation with the markets. (Berk & DeMarzo 2014, 337-338)

Mathematical formula for calculating Beta:

$$\beta_i = \frac{Cov\ (R_i, R_{Mkt})}{Var(R_{Mkt})} \quad (2)$$

Where:

β_i is the Beta of the security

R_i is the return of the investment

R_{Mkt} is the return of the market

2.5 Sharpe Ratio

To help making investments more comparable between each other, a risk adjusted return can be calculated. For this purpose, one commonly used figure is Sharpe ratio. The Sharpe ratio is developed by William Sharpe and it was published in 1966 in his paper. (Sharpe 1966.) On 1966, the ratio was called reward-to variability ratio. Sharpe ratio calculates the portfolio's excess return in relation to the volatility of the portfolio. The figure determine how many unit of risk have been taken to obtain one unit of return, or on the other way around, how much extra profit have been obtained with same level of risk. On it early days, the Sharpe ratio was calculated by using expected returns in calculations but in modern days the expected returns have been replaced with actual historical returns in calculations. (Sharpe 1964, 425-442.)

Higher the Sharpe ratio of the investment instrument is, the better the instrument has performed in relation to its risk. The negative Sharpe ratio indicates that the investment instrument has performed worse than the risk-free return. Usually Treasury Bill (T-Bill) of U.S. government and its interest rate is considered as a risk-free investment when calculating the Sharpe ratio. (Kidd 2011, 1-4.)

Mathematically, the Sharpe ratio formula is expressed:

$$SR = \frac{R_p - R_f}{\sigma_p} \quad (3)$$

Where:

SR is Sharpe ratio

R_p is portfolio's return

R_f is risk-free interest rate

σ_p is portfolio's standard deviation

2.6 Tracking Error

One of the important features when comparing the performances of portfolios, ETFs and other vehicles that follow an index is the tracking error. Academically the tracking error can be described as the annualized standard deviation of the variation between index's and portfolios return. More commonly used formula uses the net asset value return instead of using the normal return in calculations. This simpler version is sometimes referred as a tracking difference. The tracking difference is the difference between the return of the index and the actual return of the fund. The difference between these two calculation methods is that when the standard deviation is used, the outcome is always a positive value. When calculating the tracking difference, the outcome value can be either positive or negative value and can therefore better reflect the performance of the fund in relation to the index. Practically the tracking difference is usually negative and therefore indicates that the funds have tendency to underperform the benchmark index. (Johson, Bioy, Kellet & Davidson 2013, 5.)

There are various reasons that prevent the ETF to fully replicating the index and therefore create difference in returns. One major reason for the tracking error is the cash drag issue. Because the dividends are not paid to the investors nor reinvested in a same day when they are paid, unlike is expected in the index, this causes a difference between portfolio and the index. Also, unlike the funds, the index does not require or include any cash. On the other hand, the funds do require legally defined amount of cash to pay the administrative costs. Other reasons for tracking error can be also the fund manager's inability to buy or sell illiquid assets. There are also regulations that

prevent the fund manager of investing more than a certain percent of the NAV of the index into a certain security. The imitation of the index might become a challenge if some asset holds a dominant position in the index. (Morningstar ETF Research 2013, 5-8.)

Mathematically, tracking error is expressed:

$$TE = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_{p.t} - R_{i,t})^2} \quad (4)$$

Where:

TE is tracking error

$R_{p.t}$ is the return of the ETF's Net asset Value

$R_{i,t}$ is the return of the index

T is the number of observation

2.7 Jensen's Alpha and R-Squared

Jensen's alpha is a risk-adjusted measure of the portfolio's performance. The figure is formed from CAPM and it was published in 1968. (Jensen, 1968, 389-416.) In his research Jensen studied 115 mutual fund managers over a period from 1945 to 1964 and calculated how much excess return they manage to earn over the expected return on selected level of risk in their portfolios. So in practice, the Jensen's alpha is the difference between actualized return of the portfolio and the theoretical return of the portfolio formed from CAPM**.** A positive Jensen's alpha indicate that the portfolio manager have outperformed the benchmark index's return more than indexes beta indicate. Many academics have argued that repeatedly positive alpha value is contrary with the basic assumptions of Capital Asset Pricing Model's that the markets are efficient. (Jensen, 1968, 389-416., Gerber and Hens 2009, 6.)

Mathematically, Jensen's alpha is expressed:

$$\alpha_p = R_p - E_{(Rp)} \tag{5}$$

Where:

α_p is the portfolio's alpha

R_p is the actual portfolio's return

$E_{(Rp)}$ is the expected return derived from Capital Asset Pricing Model

R-squared is a statistical figure that measures the correlation of the variance in funds return compared to the variance in benchmark indexes return. R-squared is essentially connected to the reliability of the alpha and beta value because the value shows how equal the movement of the fund is compared to the market movements. If the alpha value is 1, this express that all the changes of the portfolio can be explained by changes in the benchmark index. If the R-squared value is lower than 1, that the correlation between the portfolio's variance in returns and the markets return are fragmented and there is no correlation. If the correlation is low or doesn't exist, that invalidates the calculation of alpha and beta values. (Bacon 2008, 66.)

Mathematically, R-squared is expressed:

$$R^2 = \frac{Systematic\ variance}{Total\ variance} \tag{6}$$

2.8 Indexes

In finance, indexes are used to present the general development of a specific stock market, industry or a market. Indexes are calculated daily for stocks, bonds and commodities such as oil, gold or pork bellies. An index follows the performance of the selected security by adding together their prices in proportions of selected weights and divided by the amount or weight of the securities. The index can be designed to follow global or national stock exchange or development of a certain industry. Each country's stock exchange has an index of its own, that represents the development of that stock

exchange. Example of this kind of indexes is NYSE Composite Index that includes all the listed stocks in New York Stock Exchange. (Investopedia: Index, Ferri 2007, 89.)

In related to ETFs, Indexes can be divided into two main category; Market index and strategy index. Usually market index covers broad selection of stocks or other securities to capture the broadest sampling of the markets the index aims to describe. The index basket can be as large as wanted and it can include as many as all of the listed stocks in the market. (Ferri 2007, 83-84.)

Strategy index has usually highly sophisticated methodology when choosing the components to the index basket. The strategy index aims to identify and to include only profitable or other way promising securities to the basket. Because strategy indexes are highly influenced by the investment philosophy of the index provider and the methodology of forming the index, strategy indexes carry higher risk and return profile than general market indexes. (Ferri 2007, 85,87.)

The indexes can also be provided by companies. Some of the most famous indexes provided by company are Dow Jones, Morgan Stanley Capital International (MSCI) and Standard & Poor's 500. Usually there are two methods of calculating the return of an index, price return and net return. A price return of an index calculate only for the changes in the price for the stocks included the index, where net return index also takes into account the dividends of the stocks. (Opi osakkeet 2007, 31)

3 Part I: Water industry

3.1 Introduction

Water is essential for all life on our planet. Approximately 70% of our planet is covered with water but only less than one percent of all water is drinkable. Water is also essential for the economy. For decades, drinkable water has been taken as a granted in western countries and water have not been seen as a limited resource. This is understandable because in many developed countries the crystal clear drinkable water flows from the taps everywhere: on our home, our schools, our work place and even at the gyms we use.

In Finland, even the water we use to flush the toilet is 100% pure and drinkable. Because of this effortless access to this low-priced commodity, most of us don't think twice what it takes to produce this effortlessness, or how much we consume this finite resource on a daily basis, directly or indirectly. For most of the world, clean drinking water is not a self-evident but more like a precious commodity.

Although 70% of the planet is covered with water, we rely mostly on annual precipitation. From this water about two thirds evaporates into atmosphere and 20-25% flows into waterways and is not fitted for humane usage. This leaves only about 10% of all water for industrial, agricultural and personal usage. At total this is some of from 9 000 to 12 000 km 3 of water. (RobecoSAM 2015, 3.)

This precious resource is also not evenly distributed: approximately 1.2 billion people live in areas with water scarcity and over 2.5 billion people live without access to an adequate sanitation. In countries with ample rainfall, such as Switzerland, more than 5000 cubic meters of water are available per person per year. In the US the same figure is around 8 000 cubic meters per person per year, but in the driest part of Africa it's less than one tenth of that amount. The average European uses between 150 and 400 liters of water every day for personal use and in US the personal use is almost twice as high, at 560 liters per day. In China ordinary person consume only 130 liters per day and in developing countries the figure is well below 50 liters per day for one person. (RobecoSAM 2015, 7.)

In a global perspective, megatrends such as population growth, climate change, growth of global GDP and aging infrastructure create both risks and opportunities for both companies and investors**.** (RobecoSAM 2015, 2.)

Currently most of the economic models do not properly value the essential services provided by the freshwater ecosystems. Often this leads to unsustainable use of water resources and ecosystem degradation. Also, pollution from untreated residential and industrial wastewater and agricultural run-offs weakens the capacity of ecosystem to provide water-related services. Ecosystems across the world remain under-valued, under-recognized and under-utilized within most economic and resource management approaches. (WWDR 2015, 3.)

From humane perspective, access to clean water can have a huge impact to human wellbeing and reducement of poverty. Access to clean water can reduce poverty, and have direct impact by reducing health costs, increasing economic activity and produce time-savings. In developing countries lack of water supply, sanitation and hygiene (WASH) takes a huge toll on human health, wellbeing and loss of an economic activity. It is estimated that in developing countries the return on investment in water and sanitation services have been 5 to 28 us dollars per dollar. (WWDR 2015, 3.)

From economic perspective, water is everywhere and it plays a fundamental role in the world's critical economic sectors from agriculture and food production to gas and oil production, to manufacturing of the semi-conductors. The water is used in the manufacturing processes for cooling, cleaning, for extraction purposes and as a direct ingredient. Every time a good is either bought or sold, there is a virtual exchange of water. This virtual water is the amount of the water which is been used to manufacture and to transport the end product. The inevitable outcome is, that more the economy grows, the more grows the consumption and demand of the water. Over the course of 20th century the water consumption have outweigh the population growth. (Henderson & Parker 2012, 3.)

3.2 Sectors of the Water Industry

One estimation of the current size of the global water market puts the total value about 591 billion US dollars at 2014. The estimation made by GWI include 203 billion from municipal capital expenditure, 317 billion from municipal operating expenditure, 1 billion from industrial capital expenditure, 37 billion from industrial operating expenditure, 12 billion from point of use treatment and 3.7 billion from irrigation. Market opportunities related to the water industry are expected to grow one trillion US dollars in 2025. (Henderson & Parker 2012, 20.)

The water industry can be divided into three main areas: Urban water management, agriculture and industrial usage. Globally about 10% of consumed water goes into domestic use, 20% goes to industrial use and about 70% of all water goes to agricultural use. In developed countries the industrial use consume half of all water while in developing countries agriculture consume more than 80% of all water. (RobecoSAM 2015, 4.) One of the main tasks of water industry is to provide water of sufficient purity and sufficient quantity for domestic use, industrial use, and for the needs of agriculture. It is

difficult to have an exact estimate on how much water is consumed and how much each sector consumes and the percent estimations differ in this thesis depending on the source of information.

3.2.1 Industry

In industrial production, water plays a fundamental role. Industrial water use covers about 16% of all global water consumption and the consumption of those processes are projected to increase 22% by year 2030. (2030 Water Resources Group 2009, 6) Water is used in several industrial processes from extraction of natural resources in oil and gas or mining to supplying ultrapure water for microelectronics and pharmaceutical sectors. Water is also used in the production of paper, textiles, electricity generation, mining, oil production and in pharmaceutical drugs. In 2009, industrial production consumed globally about 800 km3 of water and it is estimated to grow 1,500 km3 in 2030. Water is used either for a cooling, lubing or as a direct ingredient. Roughly 75% of all industrial consumed water is used for energy production and cooling. (RobecoSAM 2015, 9.)

The industrial sector also produces a lot of contaminated water which need to be adequately treated before it is discharged. This sector shows particular growth potential in China and India, where untreated industrial wastewater and effluents are pumped into rivers without any kind of treatment. The overall industrial water capital expenditure market was worth an estimated 15 billion us dollars in 2011 and it is expected to grow 24 billion in 2018. (RobecoSAM 2015, 31.) The industrial wastewater treatment market faces increasing growth potential as environmental regulations grows stricter and stricter. The OECD Environmental Outlook to 2050 (OECD 2012, 4.) predict that global demand for water in manufacturing will increase by 400% from 2000 to 2050.

In the industrial use, the water related challenges comes from balancing between the need for sustainability and water resources conservation and need for productivity. The primary purpose of every company is to produce profit to the owners and to maximize the profit, and therefore water efficiency and conservation may not be high in company's priorities. In developing countries, the challenge for industry is to gain reliable access to secure water resources and the maintenance of those sources. In developed

countries the main challenges is mainly in the efficiency measures to conserve already existing water resources. (WWDR 2015, 59.)

Because industry's first priority usually is to maximize the profit, the improved water efficiency may not decrease the water consumption if the water savings are reinvested to increase production. Therefore the process of production may be more efficient, but no actual water is achieved. Industry has the tendency to seek self-sufficiency or to obtain access to public water supplies at the lowest possible price, even if the value of the water for industry is high. (WWDR 2015, 60-61.)

The common problem of water use in industrial use is the internal rate of return (IRR). The investment in water efficiency and technology may have longer payback periods than the immediate or short-term returns from alternative investment in production. Also, the low or even non-existing water prices do not encourage investing in water efficiency. Controversially, it may become less expensive for company to pay fine for pollution than to invest in water efficiency. (WWDR 2015, 60-61.)

The actions for industry to improve water efficiency and sustainability come usually from one of two directions: from top-down or bottom-up. Top-down approaches are those political and legal authorities, such as, government, initiate. This includes command-and-control via standards, permissions, prohibitions, regulations, fines, charges, etc. The bottom-up approach comes from industry when it reacts to government's approaches by forming internal policies and by reacting the demands of customers, owners and public pressures. (WWDR 2015, 60-61.)

Mechanisms to encourage companies to be more water-efficient can include monetary penalties for noncompliance and charges for water withdrawals and wastewater discharge. The water prices can be influenced through taxation, royalties and water quantities may be regulated via tradable permit systems, as is done to prevent climate change. Taxation may advance water-efficient technology and tax exemptions could favor more water-efficient products. (WWDR 2015, 62.)

It is recognized that many inefficiencies in water use, both domestic and industrial, is caused by subsidies that distort the price of water below its full cost, and therefore the users do not pay the full cost of the water they consume. It is also important to be able to measure the amount of consumed water. (WWDR 2015, 62.)

Reliable and accurate information and data is essential to all management activity. Therefore Water Footprint Assessment (WFA) helps to account both direct and indirect use of freshwater in the production manufacturing process. WFA can be applied both on production processes as well as supply chains. It is estimated, that more than 80% to 90% of all consumed water in company's water footprint comes from beyond direct operations and therefore most of the risks are outsourced, too. (WWDR 2015, 62.)

3.2.2 Agriculture

Agriculture consumes about 70% of all water consumed in the world, and thus agriculture is the heaviest water consumer of all sectors, because the food production is extremely water intensive. It takes 15,400 liters of water to produce one kilogram of beef, 2,500 liters of water to one kilogram of rice and 1,600 liters to one kilogram of bread. It goes without saying that more the meat consumed in a diet, the higher the associated water use is. In 2009 agriculture activities extracted around 3,100 square kilometers of water and the consumption is expected to reach 4,500 square kilometers by 2030. By 2050 agriculture need to produce 60% more food on globally and 100% more in developing countries. (WWDR 2015, 48)

Irrigated agriculture contributes currently around 40% of all food production and the rest 60% comes from rain fed systems. Today most of the fields are irrigated with ditches or sprinkler systems. These systems are relatively economical for the farmers but also inefficient because most of the sprinkled water gets wasted. Modern micro irrigation systems may save 30% to 70% of water needed for irrigation, but the savings depend heavily on water tariffs. Usually the farmers purchase their own irrigation systems and the available amount invested for irrigation systems depends highly on farmer’s income, the price of water and the willingness of authorities to restrict illegal water use. The higher the price of water is, the more likely the farmers are willing to invest for efficient irrigation systems. (WWDR 2015, 48-50)

To solve water related problems in agriculture, the sector have two options: it can either increase water use efficiency or increase water productivity. The first option tries to gain water efficiency in the process production. In general management approaches this mean reducing the non-profitable use of water such as leakages and evaporation.

In the first option, there are some limitations: only part of the “lost” water (as defined as water that is diverted for clear and tangible purpose) can be saved effectively at reasonable cost, and part of the “lost” water return to the hydrological cycle, for example water lost through evaporation. The amount of lost water through evaporation and drainage varies according to local conditions. Therefore clear understanding of the real potential for water savings is needed to avoid inefficient and costly demand management strategies. (WWDR 2015, 48-50)

The second option focus on productivity by increasing the crop productivity per used water unit. (“More crop per drop”) In most cases, the most important way of managing water demand in agriculture is by increasing the agricultural productivity. This can be done by selecting and altering the genetic material of the plant, improving soil fertility and plant protection. Biotechnology can increase the harvestable parts of the plants and reduce the biomass losses by increasing the resistance of the plant against pests and diseases. (WWDR 2015, 48-50)

3.2.3 Domestic Use

At very basic level, all humans need access to clean and safe water in adequate quantities for drinking, cooking and personal hygiene and access to hygiene sanitation facilities that doesn’t compromise health. Lack of water and these WASH -services compromise health and well-being and come with large economic costs and economic losses in form of increased health costs and losses in economic activity. Because of the very basic nature of need for clean water, the access to clean water and hygiene is recognized as a human right and has been long for target of international development policies. (UNCESCR, 2003)

In domestic use, the quantities of consumed water are generally small compared to industrial or agricultural usage. The World Health Organization (WHO) 2011 sets value, that access to 20 liters of water per person per day is adequate amount of water for drinking and personal hygiene. From all water withdrawals, domestic use of water covers around 11% of all freshwater withdrawals. (WWDR 2015, 39.)

When societies develop, their water consumption patterns change. On global level the consumption of water per capita increase with economic growth and societies move to

use more and more of piped water. It is estimated that around 6% of world's population rely primarily on bottled water and this trend set concerns about the sustainability of this trend. The water consumption per capita have increased from 467 to 634 cubic meter per person per year and for each incremental added million dollar for the global GDB, an additional 22 000 cubic meter more of water is required per year. One estimation from UK states, that the direct amount of used water per day on average person is around 150 liters. This estimation does not include the virtual water, the water that is used to produce the goods. The estimation says that the actual amount of consumed water can be thirty times higher. The estimation of 2030 Water Resources Group states that in 2030, the global withdrawal for agriculture alone could match the current global consumption of all purposes. This estimation does not include withdrawals for domestic, municipal or industrial purposes, which are also on growth, with industrial use growing fastest. (Henderson & Parker 2012, 4.)

From domestic perspective, one of the biggest challenges globally is the lack of access to proper sanitation. It is estimated that 2.5 billion people do not use improved sanitation utilities, 1.8 billion people drink water with polluted by Escherichia coli and it is estimated that in upper-middle income countries wastewater from 75% of all households with sewer connections doesn't receive proper treatment. It is estimated also, that up to 90% of all wastewater generated in developing countries have no treatment at all, and are discharged directly into rivers, lakes and to ocean. (WWDR 2015, 44.)

The releasing of untreated human excreta has negative impact on environment and the risks for health are obvious. From perspective of sustainability, it would be more productive to find a way to use the wastewater in productive way for example in agriculture to relieve stress on water resources, and to avoid losses of nutrients. This kind of reuse would also be practical, because to ensure the sustainability of all provided services around the globe, the type of services need to match the available infrastructure and human and finance resources. For example, the idea that everyone should have a sewer-connected flush toilet, may set challenges for management of the wastewater and create economic challenges. (WWDR 2015, 38-40.)

3.2.4 Energy Sector

Currently the energy sector account around 15% of world's total water consumption and it is estimated to increase by 20% through 2035, (WWDR 2015, 11.) where IEA estimate that global energy demand increase by one third by 2035 and demand for electricity to grow by 70%. At this point, it is worthy to notice that "energy" and "electricity" are two different cases. Energy can be any source of power where electricity is just one form of energy.

Access to energy is almost as necessary as access to food or water for modern people. We use energy for cooking and heating and nearly all forms of energy require some part of water for production. Thermal power and hydropower cover 80% and 15% of all global energy production, and both of them are highly water intensive forms of energy. Energy is also required for the collection, treatment and delivery of water and it is estimated that the electricity costs forms 5% to 30% of all operating costs of water and wastewater utilities. Energy is also consumed on households when water is pumped from wells or heated for cooking and cleaning. On globally, around 2.6 billion people use solid fuels, such as biomass, for cooking, 400 million rely on coal for cooking and heating and over 1.3 billion people do not have access to electricity. (WWDR 2015, 54.)

Globally the transition away from fossil fuels will be slow and the demand for all forms of energy is expected to increase: Oil by 13%, coal by 17%, natural gas by 48% nuclear by 66% and renewable by 77%. Globally the energy production will be dominated by thermal energy production from coal, natural gas and nuclear energy. (WWDR 2015, 54.)

Because 90% of thermal power is water intensive, it is estimated that that 70% increase of energy production by 2035 will increase 20% of clean water withdrawals. From global energy mix the wind and solar energy account only for 3% and although they are in rapid growth in upcoming decades, they are not expected to represent more than 10% of global electricity generation. (WWDR 2015, 54.)

According to the international Energy Agency (IEA), the amount of water required for energy production will increase somewhere between 20% to 35% by 2035 to satisfy the need of future energy needs, depending on the selected energy strategies of the future.

(RobecoSam 2015, 12.) In water and energy intensive industries, such as oil and gas development, power production and steel industry, this means that the market for solutions that maximize the efficiency both on water and energy consumption is predicted to grow dramatically.

3.3 The Global Megatrends

The current state of water resources and scarcity is threatened by many factors: Pollution and contamination, unsustainable withdrawals, climate change, population growth, urbanization and rising income level of world's population. All these factors are steadily increasing the global demand for clean water and many countries are already facing a remarkable gap between the amount of needed water for the economy and the people and the amount they can reliably provide.

3.3.1 Pollution: Examples China & India

In India, the Ganges River is the most used river for water extraction and also one of the most polluted rivers in India. 420 million people rely on Ganges for food, water and bathing, agriculture and for spiritual need, such as place for burial. Ganges River has long been used also as an open sewer where wastewater has been pumped without any kind of treatment. Therefore the river is severely polluted: 100 milliliters of water of Ganges can hold as much as 1.5 million counts of fecal coli form. (Henderson & Parker 2012, 35.)

Another dramatic example of water crisis and pollution comes from China. In China, the rapid urbanization and the growth of the population and economy require large-scale amount of both electricity and water. In China, the water challenges are exacerbated by geographical differences in water availability. For example, in south water is more abundant than in North, where agriculture and country’s most water-intensive industry sectors, such as mining and petrochemicals, are located. It is estimated that about 67% of China’s energy production is located on areas with severe water scarcity. These areas face also severe level of water contamination.

The waters are contaminated by tailings, fracturing fluids, flow back waters from mining and production. Also, high levels of heavy metals have been found in soil and waste water streams. At the same time, International Energy Agency estimate that China's primary energy need will increase 60% from 2010 to 2035 and under this scenario, the water withdrawals for energy demand is expected to increase about 38%, and water consumption is expected to grow 86%. (Henderson & Parker 2012, 37.)

China has also the largest shale gas reserves in the world and the future growth in China's shale gas production will put more stress both on China's water resources and quality. China plans to increase the shale gas production up to 30 billion m3 by 2020, implying that an additional 200 million m3 of water would be required. This amount of water is about equivalent to the annual consumption of four cities with population of one million people. This would require an estimated 9,000 to 29,000 m3 of water per well and between 2,520 to 3,000 wells would be required to produce 9 billion m3 of shale gas in year. (Henderson & Parker 2012, 38.)

3.3.2 Pollution in Developed Countries.

In past decades, the developed countries have started to pay attention on industrial polluting, but there are many threats to water resources. One of them is micro pollutants that conventional water treatment technology can't remove from water. These pollutants, such as endocrine-active substances from pharmaceutical drugs, are often met at small and medium-sized watercourses in densely-populated and intensively-farmed regions. Conventional water treatments are not designed to remove these pollutants from drinking water, but many new technologies, such as disinfection with ozone, chlorine or chlorine dioxide, ultraviolet radiation and purification by using membrane filters, exist already for the purpose. It is estimated, for example, that in Switzerland the upgrading of existing wastewater treatment facilities will cost 1.2 billion us dollars over the next 20 years. (Henderson & Parker 2012, 29.)

It is estimated, that the volume of municipal wastewater produced globally per day is about 684 million m3 but the total capacity of tertiary and advanced reuse of water produced per day is only about 30 million m3. This leaves a plenty of room for growth in advanced water reuse markets. The challenge in wastewater lies in processing the

water in the way that it can be reused for irrigation, groundwater recharge, or even reuse for potable water supply. (RobecoSam 2015, 29.)

One solution for water production could be desalination. Desalination is a process where salt and other minerals are removed from seawater to make it drinkable or to obtain ultrapure water for industrial use. As of 2014 about 1% of all consumed freshwater globally was derived from desalination. Currently there are now over 17 000 desalination plants in 150 countries that provide clean water for more than 300 million person worldwide. Increase of desalinated water has increased rapidly: in 1970 less than 0.8 million m3 of water were desalinated globally per day. This figure has increased over 80 million m3 per day in 2014 and it is forecasted to grow 128 million m3 per day by 2018. (Henderson & Parker 2012, 29.)

The cost of desalinated drinking water has declined significantly in past 40 years: In 1970 it cost as much as 10 U.S. dollars to produce one cubic meter of desalinated water. Modern desalination facilities have brought the costs down below one dollar per cubic meter of water. Development of new technology such as renewable energy, reverse osmosis (RO) and membrane flux rates have reduced the costs of desalination. Industrial use of desalination is expected to grow in double digit rates in upcoming years.

3.3.3 Climate Change

The essence of sustainable use and management of freshwater resources is to balance between supply and demand, while ensure proper both quality and quantity for industrial, domestic and agricultural use for present and the future. In the situation of growing demand and limited resources of freshwater, the climate change will effect in several ways on natural water balance and water availability.

Due to climate change we can expect higher evaporation of from open surfaces and soils due increment of temperature, stronger variability in precipitation patterns, increased transpiration of vegetation and potentially reducing water availability. It is difficult to determine the specific impacts of climate change to the local water sources because local and regional weather patterns are usually poorly resolved by global climate models. Some of the risks are easier to predict than others. Some of the more predictable risks are facing fastest growing megacities that are often located in coastal areas.

Those areas are facing the threat of sea level rising and flooding and degradation of essential ecosystems. Also the melting glaciers, drying wetlands, soil erosion, and deforestation may disrupt the mountain ecosystems. (WWDR 2015, 65-66.)

3.3.4 Population growth

The current population of the planet is approximately 7 billion people, and the population will keep growing in upcoming decades. The United Nations estimate that the population of our planet will increase to 9-9.6 billion people by year 2050. It is estimated that over four billion of these people will be living in regions which suffer chronically short water supplies. Current demand for clean water is already putting a pressure on global freshwater sources and supplies by causing pollution, depletion and inequality on both accessibility and quality. (Henderson & Parker 2012, 3.)

Due to growth of the population, the demand for clean water will only increase in upcoming decades. Academicals studies have showed that in past decades, the water consumption has grown at a faster rate than the growth of population: Over the last decades the rate of water consumption has doubled the rate of population growth. This is caused by continuous improvement of living standards and economic growth and it is unlike that this trend will reverse in the future. (USCB, 2012)

Because of the growth of the population, by 2050 agriculture will need to produce 60% more food globally and 100% more in developing countries. At current rate of growth, global agricultural water demand is unsustainable, and the need to increase the water efficiency by reducing water losses and to increase crop productivity (“Crop per drop”) is strong. The surge will be driven mainly for developing countries, where growing middle class is adopting the western eating habits and the demand for water intensive food, such as beef, is on increase. (WWDR 2015, 3-4.)

Currently the growth of the global gross domestic production (GDP) is at an average of 3.5% per year from 1960 to 2012. (World Economics, 2016) This growth along population growth, urbanization, increase of production and consumption, has generated ever-increasing demand for freshwater resources. The increase for water demand have come need of food, fibers and energy. Also strong income growth and rising living standards and consumption patterns of growing middle class have increased the consumption of water.

Changing consumption patterns, such as increasing meat consumption, using more motor vehicles, building larger homes, using appliances and other energy-consuming devices typically increase the water consumption both on production and use. Development for these patterns can be unsustainable in areas, where the water is scarce and where the usage, price, distribution, management or consumption of water are poorly managed or regulated. Demand for water is expected to increase in all sectors of production and by 2030, the world is projected to face as much as 40% water deficit globally under the business as usual. (WWDR 2015, 9-10.)

3.3.5 Urbanization

Urbanization goes hand in hand with rapid growth of population. This means that more and more people are moving from countryside to cities for hoping a better quality of life. Currently 54%, or 3.9 billion of world's population, lives in cities and UN forecasts that in 2030 the figure will reach 60%. Not only the global cities are growing in number, but also in size: In 1950 only 77 cities had the population higher than one million, but this figure have risen from 361 to 501 from 2000 to 2015. (Henderson & Parker 2012, 13.)

While the cities grow bigger, also the slum populations of these cities grow larger. The world’s slum population is expected to reach 900 million by 2020. More than 50% of the population lives in the cities with 30% of all city inhabitants residing in slums. The urban populations are projected to increase to a total of 6.3 billion inhabitants by 2050 and the UN-Habitat estimate that in Africa and Asia the urban population will double. (WWDR 2015, 3-4.)

The trend of urbanization influence several ways to the hydrological cycle. The growth of the urban population requires increasing amount of extracted surface and groundwater and by increasing the imperviousness of the ground thus increasing the risks of floods and preventing the recharge of the groundwater recharge and polluting the water resources. Also the persistently urbanizing population requires more food, energy and consumed goods from outside the city, which requires huge amount of water from production to transportation. By 2050 the global demand for water is expected to increase by 55% due to urbanization, industrialization and improving living standards and grow-

ing middle-class. The strongest growth will become from developing countries. (WWDR 2015, 42.)

3.4 Water Efficiency and Management

3.4.1 Water Ownership

The water ownership varies from country to country. In most countries, drinking water infrastructure and facilities for wastewater treatment are state owned and run by public authorities. In some countries, the services mentioned before, have been privatized partially or fully or organized as public-private partnership. (PPP) In the United Kingdom, the privatization started in 1989 and it has resulted 10 large investor-owned water utilities, which represent more than 85% of the country's total water systems. (Standard & Poor's 2012, 25-28)

In Western Europe, 47% of people are being served by the private sector, about 23% in North America and 20% in Southeast Asia. Contrary, in the United States, only about 16% of the water systems are owned by investors. All the rest is owned and managed by the local municipality or government. In globally, around 14% of all water services are provided by private operators that provide both drinking water and wastewater treatment services. Globally, the trend of privatizations seems to continue on upcoming decades and the level of privatization is expected to rise 21% in 2025. The strongest growth potential in private sector participation is expected to come from emerging market countries such as Egypt, Vietnam and India. (RobecoSam 2015, 22.)

3.4.2 Water Pricing

Water tariffs are crucial for ensuring that the utilities can cover the costs of providing the demanded services and to upgrade and expand the existing distribution infrastructure. It can be argued that in the industrialized countries, the water is underpriced. Market-based pricing is also important mechanism to encourage the consumers to monitor their water usage and to pay more attention on water efficiency. If the prices of the water are too low, consumers have no incentive to limit their water consumption. (Henderson & Parker 2012, 24.)

In service delivery, the prices and tariffs are usually based on volumetric measures of the water. In this area, the water prices do not represent the scarcity value of the water as such, but rather the delivery costs of it. In many places water services are under-priced and this results into poor service delivery, low maintenance of existing systems and infrastructure and lack of extensions to new areas because service providers are not compensated for service delivery based on the real costs of water. (Henderson & Parker 2012, 24.)

The need to expand and to upgrade the existing drinking water and sewer infrastructure compounded with the demand of higher water standards adds plenty of pressure for higher water prices. Globally there is considerable disparity in water prices between countries. In relatively water-rich France the price of one cubic meter of water is 50% higher than in relatively water-poor Spain. In Germany and United Kingdom the water tariffs does not only cover the operational costs, but they cover largely also the capital financing costs. In countries like Saudi Arabia and Ireland the government charges almost nothing from water services, but still the taxpayers bear the entire financing burden. (Henderson & Parker 2012, 24.)

On the other hand, also the poorest people must be taken into account to ensure fair and enough access to water for drinking, cooking and cleaning. Therefore some kind of pro-poor pricing policy must be adopted, while ensuring that water is priced at level that supports the maintenance and expansion of the water infrastructure.

Accurate water pricing or cost-based pricing, signals how to allocate scarce water resources to the uses of highest value in economic terms or other type of benefits. The allocation of the water between different users and different type uses is typically managed through systems of administrative permits. All pricing methods of pricing water resources are compounded by the fact, that different users and uses are differently inserted into global and local economies. (WWDR 2015, 6.)

3.4.3 Water Management

The ownership of water infrastructure has been a topic of many conversations and the debate still continues. There are some arguments that support the private ownership of water infrastructure. Privately owned companies can enable efficiency gains and provide technological improvements to gain cost-efficiency. On the other hand, privately

owned water utilities may avoid of making long-term investments in order to protect the short-term profits of the shareholders. In many countries the water resources are poorly managed. For example in Spain and France, it is estimated that as much as 30% of water is lost before it reaches the end user. In Brazil, the government reports have stated that 37% of all water is lost due to leaking. (Henderson & Parker 2012, 16.)

On a global level, the water resources are poorly managed and regulated and the international cooperation is scarce. Example of this is that out of the world's 263 transboundary water basins 158 lack any kind of cooperative management framework. This indicates that the mechanism and political will and/or resources to manage shared water resources effectively are missing. For some reason, providing of proper water and sanitation services remain rather low in the scale of political priorities compared for example education and health on official development assistance and national expenditure. Financing the water services and water resource management is also usually in low priority even though water plays a key role in most of the economic activities. (WWDR 2015, 11-14.)

In most countries, the financing of the water sector comes from the state or from the government and in developing countries the use of these resources are insufficient and the costs of infrastructure operation and maintenance are often neglected. This mismanagement leads often to damages, losses of the water resources, unreliability and decreasing of the water quality and quantity. Also the lack of reliable and objective information, monitoring and metering of the water resources are a consistent problem. (WWDR 2015, 14-15.)

Efficient and accountable water management requires political commitment, appropriate policies and legal frameworks, efficient institutions and administrative institutions to work. Also both human and economic investments are required to build, maintain and update the water infrastructure. A study estimate that one invested dollar for water and sewer infrastructure increase private output (GDP) in longer term by 6.35 us dollars and yield a 2.62 dollar output in other industries. The benefits mentioned above appear in form of created jobs, private investment and final output. (WWDR 2015, 47.)

3.4.4 Ecosystem-based Management

Ecosystem-based management is described by the United Nations Convention on Biological Diversity (CBD) as a “strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in equitable way”. This description can be seen in the quantity of water required to maintain water-related ecosystem services, and the ecosystems that serve to maintain this quantity, such as wetlands and forests. The poor and fragmented management of water resources have led to degradation of ecosystems through pollution and contamination, losses of synergies, poor trade-offs and sub-optimal solutions and economic costs. It is more expensive to repair the ecosystem than maintain it. The correct ecosystem valuation could be described as the price what users would be willing to pay directly for the natural services, or what it would cost to replace the natural infrastructure by manmade infrastructure. (WWDR 2015, 29-30.)

It is estimated that globally utility companies could save an estimated of 7-12 billion us dollars in each year by using smart water solutions. These smart water solutions include advanced leakage detection and pressure management and information systems that enable the collection and interpretation of data, which could optimize capital expenditure management. Water metering is crucial in water losses limiting and in reducing the amount of non-revenue water. Non-revenue water includes not billed water due to leakage, illegal use and inadequate measurement. It is estimated that 4% to 65% of all water in Asian cities are non-revenue water. (RobecoSam 2015, 34.)

3.5 The Future Growth Predictions of the Water Industry

The growth expectations of the water industry are positive in most of the sectors related on solving water related problems; nevertheless some sectors face better predictions of growth than others. Sectors that are expecting tremendous growth are businesses that are focusing on efficiency, re-use of water and source diversification. The Lux Research predicts, that the revenues of world’s water related businesses will rise from US$ 522 billion in 2007 to one trillion in 2020. (LoCasio 2008, 1.)

3.5.1 Four Clusters

RobecoSAM has analyzed historical data and they have defined four major investment clusters in water sector based on equity market volatilities and beta characteristics. Their study predicted promising growth expectations for utilities, capital goods and chemicals, construction and materials and for quality and analytics.

In utilities, the growth is expected to utilities that supply water and provide wastewater services for both residential and industrial use. In capital goods and chemicals, the best growth predictions are on companies that manufacture water equipment, such as valves, pumps, integrated water treatment systems, water treatment chemicals and irrigation systems. In construction and materials are included the companies that build infrastructure, such as water networks, pipelines, water channels, reservoirs and treatment plants or install water meters. In quality and analytics, the growth is expected to in sectors that include companies which are developing and selling products that help to monitor water quality and testing, water resource protection and systems to treat water at its point of use. (Henderson & Parker 2012, 25.) In totally, RobecoSam study estimate that the water market will grow 1-2 points above GDP growth, reaching to 1 trillion us dollars by 2025. (Henderson & Parker 2012, 39.)

Currently the annual capital expenditures of water utilities are estimated to be globally 100 billion us dollars and the operating expenditures are around 104 billion us dollars and for wastewater treatment being 191 and 125 billion us dollars. The regional differences at growth are significant. Based on economic growth, the need for investment are expected to grow faster in emerging markets than in developed markets, mainly due the need to catch up with the basic infrastructure.

3.5.2 Emerging Countries

Growth can also be expected from emerging Asia, Middle East and North Africa. In Middle East, the growth will be linked to providing additional water through desalination. Also, the services and technologies related to desalination is expected to have a high demand. (Henderson & Parker 2012, 27.)

The population growth and urbanization together set a huge demand for wastewater treatment services and infrastructure. Over the last decade, the urbanization rate of China has been annually on average 2.9 % per year. According to Chinese Academy of Science, this could lead to a demand for an additional 1.6 billion m3 of water demand annually. The academy estimate also, that the volume of wastewater discharge has increased of 7% on average per year during the last decade. (Henderson & Parker 2012, 14.)

In globally, the greatest increase of water use will come from China, India and US, where population growth, growth in GDP and increasing irrigation for food production are taking a place. In China and India, the need for water will be substantial, when the people of these countries move to middle-class and adopt western eating habits (meat production) and consumptions patterns. At China, the pollution of water is already so widespread that 21% of surface water resources are unfit even for agricultural use. (Henderson & Parker 2012, 4.)

Of course, not all demand for water can be answered with large scale centralized water infrastructure. For example, in peri-urban areas, the most suitable water solutions can be decentralized small scale water solutions that can be deployed at the household or in multi-residential scale. The solutions will focus on rainwater capture, water-efficient systems, on-site water and wastewater treatments, re-use of greywater and recycling processes. (McKinsey Quaterly 2010a, 9.)

Agriculture accounts about 71% of all global withdrawals and in developing countries agriculture consume more than 80% of all withdrawals. Therefore, companies that focus on developing of productivity-enhanced seeds, drip irrigation and other agricultural technologies are also well positioned and can be expected future growth. (McKinsey Quaterly, 2010b 4.)

3.5.3 Developed Countries

Where developing countries offers vast business and investment opportunities with non-existing water infrastructure, also the industrialized countries offers plenty of opportunity for growth. Most of the industrialized countries have built their water mains in early 20th century and these water supply and sewer systems have served roughly 60

to 80 years. In many cases, these systems have reached the end of their useful life. In many countries these aging systems require vast investment for repairing and updating. Aging water systems have leaking problems and large volumes of drinking water are lost.

United States Geological Survey (USGS) has estimated that 23 million m3 of drinkable water are lost per day due to leaking. This is equivalent to the combined water consumption of America's 10 biggest cities. The American Water Works Association have released a report which estimated that one Trillion USD will be needed for repairs and expansions to US water infrastructure over the next quarter of century. (Henderson & Parker 2012, 16.)

Doshi et al. 2007 estimate that the costs required to update aging infrastructure of water treatment and expand the distribution systems would cost globally staggering 21 trillion US dollars. This estimation covers the maintaining and of the already existing infrastructure and the needed extensions required. In existing infrastructure focus will be in leak detection, in-situ pipe replacement and the optimization of the water treatment facilities. Therefore companies that are focusing on water supply and metering, pipe production or valve and pump production are well positioned and can be expected to benefit. In developing countries purely, the expected growth of the sectors mentioned before is expected to be 8-10% per year for several years. (Henderson & Parker 2012, 4.)

3.5.4 Information Technology & Data

Also information technologies (IT) plays a vital role in the development of water industry, because IT solutions can lead to better data collection and management, real-time monitoring and responding and more efficient use of input materials. Measuring, standardizing and reporting of metrics are vital for proper management of water resources. Better metrics and data analytics can help to predict probability of rainfall and to measure the moisture of the soil and therefore decrease the need of usage of water and lead to a better "crop per drop". The demand for analyzing and monitoring equipment is also on a rise. Technology that is used to measuring for example the levels of contaminants and micro pollutants, such as chemical and biological agents, dissolved oxygen, PH

levels, nitrogen/phosphorus concentrations and turbidity and also the level of pesticides and toxic chemicals. (WWF-UK & SABMiller plc 2009, 28.)

3.5.5 Ballast Water

One currently small market of water treatment with huge expectations of growth, is ballast water treatment. Ballast water is water which is pumped into cargo ships to balance the ship and help it to maintain the stability. Some of the largest ships in the world can hold as much as 100 000 m3 of water on board and then discharge this water as they load up with cargo. The process of discharge of the water holds a threat of contamination because it is estimated that 7 000 different species are carried around in ships ballast water tanks around the world. The appearance of these invasive aquatic organisms may cause ecological, economic and health risks. In 2012 the total market of this segment was about 1.4 billion us dollars but ballast water treatment is expected to be one of the fastest growing segment in water industry, with expected growth rate of 30% between 2013 and 2018. Mainly the growth in this sector is expected in disinfection, UV technologies and filtration. (RobecoSam 2012, 31.)

4 Part II: The ETFs

4.1 Introduction to the ETFs

Abbreviation ETF comes from words Exchange-traded fund. As an investment instrument, ETF lies somewhere between a mutual fund and a stock. Where fund shares are sold and bought through fund management company, the ETF shares can be bought from the authorized party (AP) or being bought and sold through a broker over a stock exchange in a same way as stocks can be. Like stocks, ETF shares can be bought and sold throughout the whole day, as long as the stock exchange is open. The ETF shares are sold from one investor to another one or ETFs can be sold directly from the issuer to investor. (Wagner 2012, 5., Ferri 2007, xvii.)

As an economical instrument, ETF belong to a group of derivatives that most commonly track some market index, price of a raw material, multiple other assets or bonds. The ETF replicate the structure of the followed index by owning the same assets in same

relation as the benchmark index does. The purpose of the ETF and the following of the index is to give the investors the opportunity to diversify their investment portfolio by investing passively in baskets that are formed from large amount of assets instead of buying each asset's single-handedly from the markets. (Wolfinger 2005, 39.)

The ETFs and index funds also answer the demand of the domestic investors to gain access to invest in foreign markets and foreign companies around the globe, where the growth of the markets and the sophistication of the investment products may be faster than in the limited homeland markets. The exchange-traded funds that invest in foreign markets can be listed in one stock exchange but they can track any market index in the world. This way, it is easier for the investor to own shares or other type of assets and commodities easily and without the transaction costs of buying those shares and assets from foreign exchanges. (Wagner 2012, 9. Wolfinger, 2005 39-43., Ferri 2007, 7.)

4.2 History of the ETFs Briefly

The first fund that can be defined as an exchange-traded fund was launched in 1990 at Canada. At that year was opened fund named Toronto Index Participation Funds at Toronto Stock Exchange. This fund followed 35 most traded stocks in Canada Stock Exchange. Three years after this, Standard & Poor's 500 Depository Receipts (SPDRs) were launched at AMEX Stock Exchange. The fund followed, as the name says, the S&P 500 index. (Ferri 2009, 12-13)

In the Europe, ETFs were launched on April 11, 2000 on the Deutsche Börse and the market for the ETFs has been growing ever since. The first ETF in Europe followed the Euro Stoxx 50 index. Until September 2015, there are 3601 functioning ETFs listed in globally in the stock markets and there is over 2.7 trillion dollar in assets under those ETFs. The growth of the markets is estimated to be 575% as compared to data from Deutsche Bank Market research 2015. At the end of the 2014, they hold approximately 357.3 billion Euros under management according to Deutsche Asset and Wealth Management 2015. This represents approximately 3.3% of the continent's total fund industry. (Deutsche Asset and Wealth Management 2015, 1.)

In the beginning, the ETFs were regulated under the same way as the close-end funds were. The problem with form of regulatory was, that because of legislation, there was a possibility of a so called dividend drag or “cash drag” where dividends are not allowed to be reinvested but accumulated into a safe account, until they are being paid to the investors in the form of cash. The modern exchange-traded funds use the open-end structure which removes the risk of the cash drag, when dividends can be re-invested on daily basis. (Investopedia: Dividend Drag., Wolfinger 2005, 41.) Because of the open-end structure of the ETF, the fund is also allowed to receive new capital in order to issue new shares after the initial public offering is already over. The ability to create and redeem additional shares at or close to NAV is what enable the liquidity of the shares and keep the performance of the fund close to benchmark index’s performance. (Wolfinger 2005, 41-46.)

4.3 Structure of the Exchange-traded Funds

The ETF’s can be divided in into physical EFTs and into synthetic ones, based on the way of owning the securities that are included in the benchmark index. The difference between these two forms is, that in physical ETF, the stocks listed in the benchmark index is actually bought and owned by the fund and the fund executes all the changes that happen in the benchmark index. This can be considered more direct and transparent way of replicating the index. In synthetic ETF, the fund enters into swap contract with one or more counterparties and set their assets into derivative instruments. These third parties promise to pay the fund the return of the followed index. In synthetic ETFs, the structure is more complex and the swap contract includes an additional counterparty risk. (Vaguard research 2013, 1-5)

The popularity of these two forms of funds varies from country to country and from continent to continent. In the United States, almost all of the exchange-traded funds are physical ones, where in Europe the synthetic ones are more popular. Reasons for this difference in preferences might lie in the differences in regulations and tax regimes. Synthetic ETFs might be considered more practical when being invested in less known markets, markets where the assets are less liquid than on average, or if market regulatory restrictions prevent direct investing for the assets. Also, some index strategies may be too costly or overly complex to be implemented by using the physical structure. One

example of this kind of case is the leveraged ETFs that could seek double or triple return compared to the benchmark index. (Dickson, Mance & Rowley 2013, 1-4)

4.3.1 The Price of the Share

The traditional mutual fund can be bought and sold only at the day's end price and the shares of mutual fund have no floating price. Because the shares of ETF can be traded continuously during the market day, it has continuously changing price. The price of an ETF share is the Net Asset Value (NAV) with some discount or premium. The Net Asset Value of an ETF is the value of one share on a specific date or time. The NAV is calculated simply by dividing the total value of all underlying securities in the portfolio (minus possible liabilities) divided by the number of the outstanding shares. (Investopedia: Net Asset Value) On ETF shares during the market hours, the Net Asset Value is calculated in every 15 second by an Authorized Party. On Exchange-traded funds the intraday value is also calculated on every day. The intraday value can be considered as a rough guideline of the price area for the investors where the prices of the buy and sell orders should be placed. However, the actual market prices that investors execute their buy and sell transactions are dictated by the classical market forces of supply and demand and therefore the actual price is independent from the calculator intraday value. (Ferri 2007, xvii., 27-28.)

4.3.2 Creation and Redemption Process

The shares of an ETF are created in process called "Creation and Redemption". In this process the shares are created and redeem continuously throughout the trading day. The process of creation and redemption involves the fund and the Authorized Party (AP), who has a key role in the process. The purpose of the creation and redemption process is to prevent the bid-ask spread, the difference in the prices of buying and selling, to widen too much. The authorized parties are independent third parties, such as Goldman Sachs and Merril Lynch, who initiate and discontinue the creation and redemption process. The purpose of using the third party is to prevent the ETF managers of misusing the process and to protect the benefit of the investor. The gained arbitrage goes to the AP and no to the fund. (Ferri 2007, 31-32)

The process begins with the announcement of changes in the composition of the benchmark index provided by the index provider. This announcement is known as Portfolio Composition File (PCF). After the announcement, the AP makes a list of the components that form his ETF and forms a type of example basket. This example basket holds the required securities in required portion that are included in the benchmark index in order to keep the fund in good reflection of the followed index. After this the Authorized Party buys and sells the required amount of requested securities from the stock market. These components bought by the AP is called “Creation unit” (usually at least 50 000 shares) and the AP is allowed to deposit securities and cash balance amount which together equals the Net Asset Value of the Creation Unit. (Ferri 2007, 35.)

The new ETF shares are created and subsequently handed over to the Authorized Party. AP performs an “in kind” exchange between the issuer of the ETF. After the AP receives the new shares, he is allowed to sell the shares to the beneficial owners either directly or indirectly through a broker or dealer to finalize the process. (Ferri 2007, 35-36)

The redemption process is technically the reverse of the creation process. The ETF shares can be redeemed with sell order made by the beneficial owners to the Authorized Party. The AP passes forward the amount of ETF shares to the ETF provider in exchange basket of securities and balancing cash amount that mirrors the creation unit. In the end, the received securities may be sold at the secondary market for an equal amount of money.

Because the size of the creation unit is usually large in these transactions and the amount of the AP is limited by permission from ETF provider, it is relatively easy to monitor the creation and redemption activities.

4.3.3 Opportunity for Arbitrage

The authorized parties are typically grand financial institutions such as investment banks that make a legal agreement with the ETF and have the right to redeem and create the shares that help in reducing the bid-ask spread (the difference between buying and selling price) between the market price and NAV when they separate too far. If

the ETFs are sold at a premium, the AP gain an opportunity for a risk-free arbitrage by buying the underlying securities, exchange them for a creation unit and after that, sell the ETF shares with higher price than what they have paid for the actual securities. On the contrary, if the ETF shares are traded with discount, the authorized party can sell the underlying assets on the stock market with a profit, buy the ETF shares at a low price and additionally exchange them for the actual securities so that the originally sold assets are again back in their possession with an arbitrage profit. The AP can repeat this process until there is no more opportunity for the arbitrage. (Ferri 2007, 36.)

4.3.4 Transaction Costs

Due the following of the index, there is no need for analyzing the development of the markets or the companies owned by the fund. Because there is no need for market analyzes, the costs charged by the management fund tends to be much lower than in traditional funds. The downside of following the index is, that the closer the ETF tries to match the benchmark index, the more transactions are required to do so. The more transactions there are, the higher are the transaction costs charged by the management company and higher transactions cost will lead to a bigger tracking error. The tracking error is the difference between the performances of the ETF compared to benchmark index. It should be noticed that because of the management fees, there will always be a small tracking error compared to index and therefore the ETFs will always at least slightly underperform the index. (Elton et al. 2003, 677-681.)

5 Mathematical Analysis of the Funds

5.1 Mathematical Framework

For this thesis, the historical price data of the ETF funds and benchmark indexes are retrieved from web pages of New York Stock Exchange. The data is collected on a weekly basis, so 52 calculation points forms the data of one year. The historical price data for U.S. Treasury Bill (T-Bill) is retrieved from the web page of U.S. Treasury. The price data for calculations is retrieved from time period of 15.6.2007 to 8.12.2016. From this historical price data, it is calculated the weekly percentage performance of the

funds and indexes (profit or loss) and from this weekly performance is calculated the key figures.

The historical price data of the funds is also set into index to start from 100 points to make it easier to compare the performance of the indexes between each other. As a risk free interest rate in the CAPM calculations the average return for T-Bill is used. The average return for T-Bill is calculated for periods of one, three, five and nine years. For the mathematical analysis, weekly return, variance, covariance and standard deviation of the return are calculated for the funds. From these values is calculated the Beta of the fund and the CAPM expected return.

5.2 Working Hypothesis

At the beginning of the thesis there were two working hypothesis. The first working hypothesis were based on the research material in part one and it was that the water industry would be an excellent investment opportunity due the fundamental importance of the industry to civilized society, farming and industrial production. Also, in the resource material stated several time the vast need for investments in the industry at the upcoming years. The resource material also pointed out that in upcoming years the consumption of water in industrial use, domestic use and farming will only increase. Because of these two drivers, it was adequate to assume that the water industry would be highly valued and profitable.

The numerical data, key figures and other findings do not support this hypothesis. The first and maybe the most important notice is, that around a year ago, when the first preparations for the thesis were made, there were eight listed ETFs in the New York Stock Exchange that invested in the water industry. When the numerical data were retrieved for the statistical analysis, only five funds were available, and from those five, one was re-launched recently and held statistical record only from period of less than a year. This means that three funds have been either closed or withdrawn from the markets. in percentage, this means that 25% to 30% of all funds were closed or withdrawn from the stock exchange during a year. It is difficult to know exactly why these funds were withdrawn, but it can be strongly assumed that it had something to do with profitability. Also, from those five founds that had available price data, one was re-launched

only couple of months ago. Therefore only four funds were left with price data from time period long enough to be analyzed adequately.

The second working hypothesis was that the performance of the studied funds would follow some kind of standard deviation. This would mean, that some of the funds would have performed better than the average of the funds and some of the funds would have performed worse than the average of the funds. The assumption was also, that most of the funds would have performed in mediocre manner. As the working hypothesis it was also assumed, that the over-performing funds would beat the markets, the mediocre funds would performed close to the markets and the underperformed funds would have lost to the markets. This hypothesis was argued by the fundamentality of the industry to people, food production and industrial production.

Also this hypothesis was proven partly wrong by the empirical data. The performance of the funds did follow standard deviation as described above, but only one of the funds manages to outperform the markets. All three performed more poorly than the overall markets. Technically the outcome is that by investing to the general markets, investor would have gained better profits than by investing in the water industry.

The overall performance of all markets, studied funds, and the bench mark index can be viewed from chart 4. in attachment 1. In this chart the historical price development is set into form of price index and the prices of overall markets, all studied funds and benchmark index stars from 100 index points.

5.3 Historical Performance of Standard & Poor's 500 (SPX)

In the study, the Standard & Poor 500 index was used as a reference to all markets. The historical performance of all markets was calculated from weekly historical price data. The performance was calculated for one, three, five and nine years. The nine years was the longest solid period of time, of which data of historical performance of the ETF funds were available. On a period of one year the return for all markets was 7,39%, for the period of three year the market return was 24,44%, for five year the market return was 80,52% and for period of nine year the overall market return was 49,28%. These returns represent the performance of overall markets and at the same

level of risk and these are the performances that the selected ETF's should perform at least.

In the total market returns it is notable, that the market return for five year was roughly twice as much as for nine year return. The most important reason for this gap is the economic crisis of 2008 and the years that followed that crisis. The research data from 15.6.2007 to 8.12.2016 shows the dramatic drop in the values of the 500 biggest companies in the U.S. When the 15.6.2007 is set as 100 index point, 6.3.2009 the index is only 44,6 point. At this point all markets had lost almost 55% of overall value. Because of this drop, the profits for nine year period are smaller than for the period of five years.

5.4 Historical Performance of Standard & Poor's Food and Beverage Index (SPSIFB)

In this study, the Standard & poor's Food and Beverage index (SPSIFB) is used as a bench mark industry index for the water industry to compare the performance of the water industry. The SPSIFB have performed return of 7,93% for one year which is slightly more than the average of the all markets. For three year, the return was 33,91% and for five year the food and beverage industry performed 107,14%. In the longest time period, nine years, the food & beverage industry performed profit of 112,51 percent. The resource data shows that the food & beverage industry didn't react as strongly to the economic crisis of 2008 as the overall markets reacted. The data shows that the food index took longer to drop than the S&P 500 and the drop was at its lowest 58,8 index point. This is approximately 10 points less drop than the S&P 500. The data also shows that the food & beverage industry recovered much quicker from the drop than the overall markets.

5.5 Historical Performance of the Water Industry

The historical performance of the ETF's was calculated on four different periods: One, three, five and nine years. The period of nine years was the longest solid period of time that price data was available. Because there were only four funds to be studied, no average figures are calculated. Instead of calculating the average returns and average figures, it is considered more suitable for the study to compare all of the funds individually. The four funds selected for the study were First Trust ISE Water ETF (FIW), Guggenheim S&P Global Water ETF (CGW), PowerShares Global Water ETF (PIO) and

PowerShares Water Resources ETF (PHO). The table below shows the expected returns based on CAPM and the actual historical performances of the funds.

Chart 1. The historical returns and CAP model return expectations of overall markets, bench mark index and the studied funds.

Name	Value	1yr.	3yr.	5yr.	9yr.
S&P 500	Return %	7,39 %	24,44 %	80,52 %	49,28 %
	CAPM	7,39 %	24,44 %	80,52 %	49,28 %
SPSIFB	Return %	7,93 %	33,91 %	107,14 %	112,51 %
	CAPM	5,96 %	18,91 %	63,84 %	34,20 %
CGW	Return %	1,85 %	9,56 %	51,84 %	11,66 %
	CAPM	6,77 %	22,11 %	75,52 %	49,75 %
FIW	Return %	32,39 %	26,29 %	97,50 %	80,67 %
	CAPM	9,15 %	27,47 %	91,11 %	55,29 %
PHO	Return %	14,95 %	2,17 %	50,18 %	17,23 %
	CAPM	9,26 %	27,58 %	92,35 %	58,65 %
PIO	Return %	-3,36 %	-4,28 %	29,72 %	-15,91 %
	CAPM	7,56 %	24,07 %	83,85 %	53,55 %

As we can see in the table above, only one ETF out of four manage to over-perform compared to the minimum expected return based on CAP model. The rest of the funds have underperformed and therefore the investor would have gained a better return with less risk by investing in overall markets. In the table we can see, that the food and beverage industry have clearly over-performed the overall markets, the CAPM expectations and all of the ETFs in all studied periods of time.

5.6 Beta

The research material in part one indicated that water industry would be defensive industry and the industry should have lower reactivity to unpredicted markets events than overall markets in general. Generally this was not supported by the founding of the study. During the research period of nine years the beta of the water funds varied from 1.01 to 1.19, as can be seen from chart 2.

Chart 2. The Beta values of overall markets, bench mark index and the studied funds.

Name	Beta	1yr.	3yr.	5yr.	9yr.
S&P 500	Beta	1,00	1,00	1,00	1,00
SPSIFB	Beta	0,79	0,77	0,79	0,69
CGW	Beta	0,91	0,90	0,94	1,01
FIW	Beta	1,26	1,13	1,13	1,12
PHO	Beta	1,28	1,13	1,15	1,19
PIO	Beta	1,03	0,98	1,04	1,09

The results conclude that at the best case, the fund investing in water industry react in tandem with the markets and from studied funds, the worst fund have relatively strong reactions to unpredicted market events. When comparing the beta values for periods of 1, 3, 5 and 9 years, the study shows that the standard deviation of singular fund are quite small. Smallest change of beta was PIO from 1.03 at one year to 1.09 at nine year period. The fund with strongest beta change was FIW from 1.26 for one year period to 1.12 for period of nine years.

On the other hand, the benchmark index, Standard & Poor's Food and Beverage Index had turn out to be truly defensive sector when it comes to beta values. The beta of SPSIFB varies from 0.79 for one year to 0.69 for period of nine years. This can be considered as strongly protective sector which react much less into unpredicted market events than the overall markets do.

5.7 Historical Volatility

Chart 3. The historical returns and standard deviation (historical volatility) of overall markets, bench mark index and the studied funds.

Name	Value	1yr.	3yr.	5yr.	9yr.
S&P 500	Return %	7,39 %	24,44 %	80,52 %	49,28 %
	Stndr.Dev	1,79 %	1,73 %	1,72 %	2,63 %
SPSIFB	Returns	7,93 %	33,91 %	107,14 %	112,51 %
	Stndr.Dev	1,83 %	1,70 %	1,70 %	2,13 %
CGW	Returns	1,85 %	9,56 %	51,84 %	11,66 %
	Stndr.Dev	1,97 %	1,86 %	1,88 %	3,02 %
FIW	Returns	32,39 %	26,29 %	97,50 %	80,67 %
	Stndr.Dev	2,54 %	2,28 %	2,23 %	3,27 %
PHO	Return %	14,95 %	2,17 %	50,18 %	17,23 %
	Stndr.Dev	2,45 %	2,24 %	2,23 %	3,48 %
PIO	Return %	-3,36 %	-4,28 %	29,72 %	-15,91 %
	Stndr.Dev	2,12 %	2,02 %	2,09 %	3,23 %

In the table above we can see the historical volatility of the returns. Technically the historical volatility is only the historical standard deviation of the returns. In the standard deviation of S&P 500 for nine year we can notice the peak of 2008 economic crisis. The volatility for one, three and five years is quite close to each other, but the volatility gap between five and nine years is notable. This same stability and peak can be noticed also in the volatilities of the water funds.

When comparing the historical volatility of singular fund, the change in the volatility between one and five years is small compared to the peak between five and nine years. From this we can deduce, that the year 2008 and three to four years after that was very turbulent and exceptional time for markets. The changes in historical volatilities of the ETFs support the founding of the beta calculations and prove that the water industry and the returns of the water industry are more sensitive for unpredicted events than the markets in generally.

5.8 Conclusions

The purpose of this study was firstly to define the current status of global demand and supply of water, investigate what kind of sectors water industry include and to summarize the growth expectations that water industry include. Secondly, the thesis studied the historical performance of the Exchange-Traded Funds that are listed in NASDAQ or in the New York Stock Exchange and invest in the water sector. The study also compared how the funds have performed against overall markets and against the selected benchmark industry. The historical price data was collected from period of nine years and it represents four funds that invest in the water sector, the S&P Food & Beverage Select Industry Index (SPSIFB) was used as a benchmark industry and Standard's and Poor's 500 index that represented the overall markets.

As a conclusion it can be said, that the first part of the thesis managed to answer the research question that were set. The first part of the thesis painted the picture of growing demand for water supply and declining resources, that are already on under risk of over-exploitation. Also, the study of researched material pointed out very common division of the water industry into three main categories, agriculture, industrial sector and domestic use. As a fourth possible main sector, energy sector were mentioned. Also, the study gives some indication on what kind of growth potential the different sectors of the water industry include. Also, the first part of the thesis managed to scratch the surface of the risks that industries and businesses may face if the demand for water is not answered.

Also, the second part of the study managed answers the research questions that were set. The historical price data of the studied funds, overall markets and the benchmark index were found, key figures were calculated and answer for the all of the research questions were found.

The numerical research of the second part of the thesis showed, that only one fund out of four manages to meet the CAPM expectations and slightly over-perform the market return. The study also proved that three of the studied funds under-performed and the volatility of the returns are notable. Therefore it can be concluded, that generally, as an investment opportunity the water industry is not as good as expected in the working

hypothesis. By careful selection the investor may win the markets slightly. If the fund to be invested in is selected randomly, the odds are strongly against the investor.

All of the funds followed an index that contains at least 35 components. At largest, the benchmarked index followed by the ETF contains 50 components. Because of this variety, it can be claimed that the four funds and the indexes they follow, cover the water industry quite well and therefore it can be summarized that the water industry does not perform well compared to the overall markets. There seems not to be any one clear reason, why the water industry have underperformed compared to the overall markets, but the study from the qualitative part of the thesis suggest some reasons for the poor performance. These reasons are mainly related in the competitive environment, where the water industry companies operate.

One reason for poor performance of the water industry might be the fact, that in many countries, the end-user of any product or service does not pay the full cost of used water to provide the product or service. This will directly decrease the profits of the water industry and generate lower profits than in scenario where the full costs of delivering and end-processing of the water would be added in the price of produced goods and services. Also, the companies operating in the water sector face competition of state-owned operators. Therefore, some sectors of the water industry lack real competition and the market environment can be considered hostile. These state owned operators might be able to provide cheaper services to end-users with poorer cost-efficiency and this way distort the natural competition of the markets.

Another reason for poor performance of the water industry might be that the water industry manufactures plenty of investment products and currently investments to these products and goods (such as infrastructure and facilities) are not being done by governments and companies. One reason for lack of this willingness to invest might be, that in western countries the water status is still relatively good and clean water is not being seen as a priority. At one hand, the politicians and policy makers are afraid of the wrath of the voters and dare not charge full price from such a fundamental commodity as water, which falls from the sky. On the other hand, the qualitative research material stated, there are not enough resources to maintain and update the water infrastructure in developed countries. Partially, this might be the case because the full costs of water are not being charged from the end-users and from those who pollute the water in production processes.

The qualitative research material also indicated, that the vast majority of the people even in developed countries lack education and knowledge about water issues, and does not understand the value of clean water. Due this, the majority doesn't understand to demand tighter environmental regulation on water consumption of companies and therefore there is no need for water efficiency neither in industry, agriculture nor in domestic consumption. This all can lead into situation, where it is cheaper to for companies to pay penalties and fees for polluting water and both domestic and agricultural users to waste valuable water resources than invest in water efficiency. All mentioned earlier decreases the profits of the water industry.

6 Discussion

Finally, it should be analysed if the research is reliable and the conclusions can be generalized to apply all markets in the world. The research can be viewed as reliable because multiple sources were used and the sources of research material for part one was considered as a reliable. The different sources of independent research material also provided similar results. The numerical research data for part two were retrieved from web pages of NASDAQ and the data can be assumed to be accurate, because the source is highly known and it has extremely strong legal obligation to provide accurate and up-to-date information. The calculated key figures were verified and the results can be viewed as accurate.

The interesting question of the study is that can the founding of the study be generalized to apply the whole world? How well do the four studied funds represent the global investment opportunities of water industry and how well do the strategic indexes represent an entire industry? And finally, how successful was the selection of the benchmark index?

There are arguments for and against if the founding of the study can be generalized to apply to the whole world. From one point of view, it can be argued that the investment markets of the United States are the biggest and most efficient markets in the world measured by the size. Consequently, if a sector cannot perform well in these markets and accumulate profits, what changes does this sector have in less developed and less efficient markets? It also speaks volumes that when the first pre-search for the thesis

were done, eight funds were found listed in NASDAQ. During the period of around one year, half of the listed funds disappeared from the markets. This indicates strongly that the funds have not performed well and for one reason or another, the funds were closed. All mentioned earlier would suggest that the results can be generalized to apply all markets.

On the other hand, it can be argued that currently there are thousands of ETF products available for an investor in dozens of stock exchanges around the world, and four funds do not represent well any specific sector. This argument is worth of considering; although the thesis is composed from the perspective of a small investor and the studied funds represent the type of investment products that small investors do have an easy access. It is possible to find privately managed Exchange-Traded Funds that perform better than the publically listed ones, but often these funds have limitations of minimum invested amount of equity for example 10 000 dollar. These limitations may narrow those funds from the reach of small investors.

Also, the question about suitability for strategy index versus broader sector index or market index to measure the performance of selected sector is interesting. Generally it is considered that strategic indexes are poor at descripting whole sectors or industries and wider sector specific indexes should be used instead. In that perspective, the strategic indexes are not the best indexes to define performance of any sector. On the other hand, the purpose of the strategic indexes is to produce profit for the investor(s) and one could argue, that for those indexes, the companies that represent the crème de la crème of selected sector, is chosen. From the point of view of investing, the strategic indexes are an excellent measure of the sector or industry.

Finally, one important question is that how good was the Standard & Poor's Food & Beverage Select Industry Index (SPSIFB) as a benchmark index? This is the question under serious examination during the entire study. The logic behind in selecting the SPSIFB as a benchmark index was, that in domestic perspective, water is equally essential for all humans as food. From this perspective, the food and beverage index works as a proper benchmark.

The water industry includes, as defined in the qualitative part of the study, three or four major subsectors; Agriculture, industrial use, domestic use and in some papers energy sector an individual sectors. The problem with the using the food and beverage index

as a benchmark is, that it equals only one sector out of three or four. At the same time, the exchange Traded Funds invest in multiple sectors inside the water industry. Perhaps a better approach for benchmarking would have been selecting three or four indexes for benchmarking each representing one of the subsectors of the water industry.

As a final conclusion it could be said that the results and findings can be generalized to represent the status in the biggest and most efficient economy in the world, and currently the studied four funds represent all the available ETF options at the U.S. markets that are listed in NYSE or NASDAQ, but the results may not be equally generalized to every other stock markets in the world. Also, it must be concluded that the water industry and the food and beverage sector do not fully correlate with each other and therefore the benchmarking manages to represent only one aspect of the water industry.

7 Subjects for Further Studies

When choosing the topic of the thesis, it was obvious that some of the research questions had to be narrowed out from the study. A few interesting questions for further studies came up and they are listed below.

7.1 Tracking Error.

The tracking error of the ETFs was narrowed out from the study. One research question for further studies could be how well the Exchange-Traded Funds have performed compared to their benchmark index and how big their tracking error is. Also, the Sharpe Ratio, Jensen's Alpha and R-Squared were introduced in the theoretical framework as in relevant general knowledge, but they were excluded from the study. It would be interesting to know how many units of extra risk have been taken to gain the results that the ETFs performed and is the water sector riskier than other sectors of industries in generally.

7.2 Public Versus Private ETFs

One interesting and possible topic for study would be also to compare the historical performance of publicly listed ETFs to privately managed ETFs and/or mutual funds that invest in the water sector. The problem with this case could be the access to the

daily or weekly price data. One possible approach for further studies could be to study how actively managed and leveraged ETFs have performed compare to passively managed funds and how actively managed mutual funds have performed compared to over all markets and to ETFs.

8 References

2030 Water Resources Group. 2009. Charting Our Water Future; Economic Framework to Inform Decision-making. The Barilla Group, The Coca-Cola Company, The International Finance Corporation, McKinsey& Company, Nestle S.A., New Holland Agriculture, SABMiller**,** Standard Chartered Bank, and Syngenta AG. [ONLINE] Available at: http://www.gwp.org/Global/ToolBox/References/Charting%20our%20water%20futureEconomic%20frameworks%20to%20inform%20decision%20making.%20(McKinsey%20y%20Co,%202009).pdf [accessed 9 March 17].

Bacon, Carl. R. 2008. Practical portfolio performance measurement and attribution, 2nd ed. Chichester: John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex, England

Damodaran, Aswath. 1999. Estimating Risk Free Rates. Stern School of Business, New York. 1-11 [ONLINE] Available at: http://people.stern.nyu.edu/adamodar/pdfiles/papers/riskfree.pdf [accessed 9 March 17].

Damodaran, Aswath. 2008. What is the Risk-free Rate? A Search for the Basic Building Block. Stern School of Business, New York. 1-33 [ONLINE] Available at: http://people.stern.nyu.edu/adamodar/pdfiles/papers/riskfreerate.pdf [accessed 9 March 17].

DeMarzo, Peter. & Berk, Jonathan. 2014. Corporate finance, 3rd ed. Pearson Education, Boston

Deutsche Asset & Wealth Management. 2015. ETF Outlook 2015. London. 1-5 https://etf.deutscheam.com/GBR/ENG/Download/Press%20Releases/3dcc0a99-abf8-4d8e-a750-9ae1b126a3a2/Deutsche-AWM-ETF-outlook-2015.pdf

Dickson, Joel. M. & Mance, Lauren & Rowley, James. J. 2013. Understanding Synthetich ETFs. Vanguard Research. P.O. Box 2600, Valley Forge. [ONLINE] Available at: https://pressroom.vanguard.com/content/nonindexed/6.14.2013_Understanding_Synthetic_ETFs.pdf [accessed 9 March 17].

Elton, E. Gruber & Brown, M. S. & Goetzmann, W. 2003. Modern portfolio theory and investment analysis. 6th Ed. John Wiley & Sons, Inc. New York.

Elton, Edwin. J. & Gruber, Martin. J. 1997. Modern portfolio theory, 1950 to date. Journal of Banking & Finance (21). 1743-1759. New York [ONLINE] Available at: https://pdfs.semanticscholar.org/fdf6/0337a0806aea8bc0e5011d9d938ae8912eba.pdf [accessed 9 March 17].

Fabozzi, Frank. J. & Gupta, Francis., & Markowitz, Harry. M. 2003. The legacy of modern portfolio theory. The Journal of Investing, vol 11, (3). 7-22. [ONLINE] Available at: http://www.cfapubs.org/doi/pdf/10.2469/dig.v33.n2.1273 [accessed 9 March 17].

Fama, Eugene. F. 1969. Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance, Volume 25, Issue 2, Papers and Proceedings of the Twenty-Eight Annual Meeting of the American Finance Association New York, N.Y. December,

28-30, 1969 (May,1970), 383-417. [ONLINE] Available at: http://efinance.org.cn/cn/fm/Efficient%20Capital%20Markets%20A%20Review%20of%20Theory%20and%20Empirical%20Work.pdf [accessed 9 March 17].

Ferri, Richard. A. 2007. The ETF book: All you need to know about exchange-traded funds. Hoboken, NJ: John Wiley & Sons.

Ferri, Richard. A. 2009. The ETF book: All you need to know about exchange-traded funds. Hoboken, NJ: John Wiley & Sons.

Frencha, Craig. W. 2003. The Treynor capital asset pricing model. Journal of Investment Management, Vol 1 (2.) 60-72 [ONLINE] Available at: http://www.finance.martinsewell.com/capm/French2003.pdf [accessed 9 March 17].

Gerber, Anke. & Hens, Thorste. 2009. Jensen's Alpha in the CAPM with Heterogeneous Beliefs. National Centre of Competence in Research Financial Valuation and Risk Management Working Paper. Vol. 317. 1-29 [ONLINE] Available at: https://www.google.fi/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwikvIGdnsTSAhVDCCwKHZxRCJwQFggcMAA&url=http%3A%2F%2Fwww.nccr-fin-risk.uzh.ch%2Fmedia%2Fpdf%2Fwp%2FWP317_A1.pdf&usg=AFQjCNFuhcMj6ny9g5LbP6a5gicXZ1WFww&sig2=LulZFHHqby2c6mUHxG2hvw&bvm=bv.148747831,d.bGg&cad=rja [accessed 9 March 17].

Henderson, David & Parker, Nicholas R. 2012 The blue Economy: Risks and opportunities in addressing the global water. Blue Economy Initiative. Toronto, Canada. [ONLINE] Available at: http://www.gordonfoundation.ca/blue-economy.ca/sites/default/files/reports/BlueEconomyInitiative%20-%20WEB.pdf [accessed 9 March 17].

Investopedia: Dividend Drag. [ONLINE] Available at: http://www.investopedia.com/terms/d/dividend-drag.asp [accessed 9 March 17].

Investopedia: Covariance. [ONLINE] Available at: http://www.investopedia.com/terms/c/covariance.asp?ad=dirN&qo=investopediaSiteSearch&qsrc=0&o=40186 [accessed 9 March 17].

Investopedia: Index. [ONLINE] Available at: http://www.investopedia.com/terms/i/index.asp?ad=dirN&qo=investopediaSiteSearch&qsrc=0&o=40186 [accessed 9 March 17].

Investopedia: Mean-Variance Analysis. [ONLINE] Available at: http://www.investopedia.com/terms/m/meanvariance-analysis.asp?ad=dirN&qo=investopediaSiteSearch&qsrc=0&o=40186 [accessed 9 March 17].

Investopedia: Net Asset Value. [ONLINE] Available at: http://www.investopedia.com/terms/n/nav.asp [accessed 9 March 17].

Investopedia: Risk Premium. [ONLINE] Available at: http://www.investopedia.com/ask/answers/05/componentsriskpremium.asp [accessed 9 March 17].

Jensen, Michael. C. 1968. The performance of mutual funds in the period 1945–1964. The Journal of finance, vol. 23(2), Papers and proceedings of the Twenty-sixth annual Meeting of the American Finance Association. Washington D.C. December 28-30, 1967 (May, 1968). 389-416 [ONLINE] Available at: http://e-m-h.org/Jens68.pdf [accessed 9 March 17].

Johson, Ben. & Bioy, Hortense. & Kellet, Alastair. & Davidson, Lee. 2013. On The Right Track: Measuring Tracking Efficiency in ETFs. Morningstar ETF Research. Morningstar. [ONLINE] Available at: http://media.morningstar.com/uk/MEDIA/Research_Paper/Morningstar_Report_Measuring_Tracking_Efficiency_in_ETFs_February_2013.pdf [accessed 9 March 17].

Khan, M. Y., & Jain, P. K. 2007. Financial management 5th ed. New Delhi: Tata McGraw - Hill. [ONLINE] Available at: https://books.google.fi/books?id=N9V34rWEOGcC&printsec=frontcover&dq=Financial+management+(5th+edition)+khan+jain&hl=fi&sa=X&redir_esc=y#v=onepage&q=Financial%20management%20(5th%20edition)%20khan%20jain&f=false [accessed 9 March 17].

Kidd, Deborah. 2011. The Sharpe Ratio and the Information Ratio. Investment Performance Measurement. CFA Institute. 1-4. [ONLINE] Available at: http://www.cfapubs.org/doi/pdf/10.2469/ipmn.v2011.n1.7 [accessed 9 March 17].

Litner, John. 2010. The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets. The Review of Economics and Statistics. Vol 47. (1) 1965. 13-37. The MIT Press. [ONLINE] Available at: http://efinance.org.cn/cn/fm/The%20Valuation%20of%20Risk%20Assets%20and%20the%20Selection%20of%20Risky%20Investments%20in%20Stock%20Portfolios%20and%20Capital%20budgets.pdf [accessed 9 March 17].

LoCascio, Michael. 2008. Lux Research Inc. Water Cultivation: The Path To Profit in Meeting Water Needs. [ONLINE] Available at: http://www-personal.umich.edu/~adriaens/Site/Water_Footprinting_files/Lux%20Research%20Water%20State%20of%20the%20Market.pdf [accessed 9 March 17].

McKinsey Quarterly 2010a. 2010. The Business Opportunity in Water Conservation. McKinsey and Company.

McKinsey Quarterly 2010b. 2010. Next-generation Water Policy for Businesses and Government. McKinsey and Company

Mossin, Jan. 1966. Equilibrium in a Capital Asset Market. Econometrica vol. 34. (4) 768-783 The Econometrica Society. 2010 [ONLINE] Available at: http://efinance.org.cn/cn/fm/Equilibrium%20in%20a%20Capital%20Asset%20Market.pdf [accessed 9 March 17].

NASDAQ: PowerShares Exchange-Traded Fund Trust PowerShares Water Resources Portfolio (PHO) [ONLINE] Available at: http://www.nasdaq.com/symbol/pho/real-time [accessed 8 December 17].

NASDAQ: PowerShares Exchange-Traded Fund Trust II PowerShares Global Water Portfolio (PIO) [ONLINE] Available at: http://www.nasdaq.com/symbol/pio/real-time [accessed 8 December 17].

New York Stock Exchange: Guggenheim S&P Global Water (CGW) [ONLINE] Available at: https://www.nyse.com/quote/ARCX:CGW [accessed 8 December 17].

New York Stock Exchange: First Trust Water ETF (FIW) [ONLINE] Available at: https://www.nyse.com/quote/ARCX:FIW [accessed 8 December 17].

OECD Environmental Outlook to 2050: The consequences of Inaction. 2012 [ONLINE] Available at: https://www.oecd.org/env/indicators-modelling-outlooks/49846090.pdf [accessed 9 March 17].

Opi osakkeet. 2007 OMX Pohjoismainen Pörssi. 3rd edition. Helsinki

Pandey, I. M. 2015. Financial management 11th ed. Vikas Pub. House. New Delhi. [ONLINE] Available at: https://books.google.fi/books?id=vahDDAAAQBAJ&printsec=frontcover&dq=Financial+management++pandey&hl=fi&sa=X&ved=0ahUKEwjZw5Kxg8TSAhWJB5oKHYXqBmQQ6AEIFzAA#v=onepage&q=Financial%20management%20%20pandey&f=false [accessed 9 March 17].

Puttonen, Vesa. & Repo, Elijas. 2007. Miten sijoitan rahastoihin. WSOY. Helsinki

Reilly, Frank. K. & Brown, Keith. C. 2002. Investment analysis and portfolio management 6th ed. CITIC Publishing House. [ONLINE] Available at: https://books.google.fi/books?hl=fi&lr=&id=pZfeJ75ZRJ0C&oi=fnd&pg=PA2&dq=Investment+analysis+and+portfolio+management+(10th+ed.)&ots=5fdX-Nzb6W&sig=ICx4CpFg3gPX82oK7mhxzygj3XI&redir_esc=y#v=onepage&q&f=false [accessed 9 March 17].

RobecoSAM. 2015. RobecoSam Study: Water, The market of the future. 06/2015. Carbon neutral Publication. Zurich, Switzerland. [ONLINE] Available at: http://www.robecosam.com/images/Water_Study_en.pdf [accessed 9 March 17].

Sharpe, William. F. 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. The journal of finance. vol. 19(3). 425-442. [ONLINE] Available at: https://psc.ky.gov/pscecf/2012-00221/rateintervention@ag.ky.gov/10252012f/sharpe_-_CAPM.pdf [accessed 9 March 17].

Standard & Poor's Rating Services. 2012. CreditWeek The Global Authority On Credit Quality. March 7, 2012. Special Report: Water The Most Valuable Liquid Asset? Vol.32 (9) [ONLINE] Available at: https://www.cfasociety.org/nebraska/Lists/Events%20Calendar/Attachments/60/SP%20Water%20Special%20Report%20Mar%202012.pdf [accessed 9 March 17].

Stotz, Olaf. 2005. Active Portfolio Management, Implied expected returns, and analyst optisim, financial markets and portfolio management. vol.19 (3) 261-275. Swiss Society for Financial Market Research

Sullivan, Edward. J. 2006. A Brief History of the Capital Asset Pricing Model. APUBEF Proceedings. 207-210. [ONLINE] Available at: https://pdfs.semanticscholar.org/6959/9b6e39197761b95ebd4c2e92c4c25d1f9d31.pdf [accessed 9 March 17].

Treynor, Jack L. 1962. Toward a theory of market value of risky assets. Un-published manuscript. [ONLINE] Available at: http://www.empirical.net/wp-content/uploads/2014/12/Treynor-Toward-a-Theory-of-Market-Value-of-Risky-Assets.pdf [accessed 9 March 17].

UNCESCR (united nations Committee on economic, social and Cultural rights) 2003. General Comment no. 15: the right to Water (arts. 11 and 12 of the Covenant) 20 January 2003. e/C.12/2002/11.

USCB (United States Census Bureau). 2012. International Programs. World Population. [ONLINE] Available at: http://www.census.gov/population/international/data/worldpop/table_population.php [accessed 9 March 17].

U.S. Department of the Treasury. [ONLINE] Available at: https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2008 [accessed 9 March 17].

Wagner, Deron. & Farley, Alan. 2012. Trading ETFs: Gaining an Edge with Technical Analysis. 2nd ed. Bloomberg Press. John Wiley & Sons Inc. Hoboken, New Jersey.

Wolfinger, Mark D. 2005. Create Your Own Hedge Fund. Increase Profits and Reduce risks with ETFs Wiley. John Wiley & Sons, Inc. Hoboken, New Jersey

Wikipedia The Free encyclopedia: Security market line [ONLINE] Available at: https://en.wikipedia.org/wiki/Security_market_line [accessed 14 March 17].

Wikipedia The Free Encyclopedia: Modern Portfolio Theory [ONLINE] Available at: https://en.wikipedia.org/wiki/Modern_portfolio_theory [accessed 14 March 17].

WWDR 2015. The United Nations World Water Development Report 2015: Water for a sustainable world. United Nations Educational, Scientific and Cultural Organization, UNESCO [ONLINE] Available at: http://unesdoc.unesco.org/images/0023/002318/231823E.pdf [accessed 9 March 17].

WWF-UK and SABMiller Plc. 2009. Water Footprinting: Identifying and Addressing Water Risks in the Value Chain. WWF-UK and SABMiller Plc. [ONLINE] Available at: http://awsassets.panda.org/downloads/sab0425_waterfootprinting_text_artwork.pdf [accessed 9 March 17].

Chart 4. Historical price index development of overall markets, studied funds and benchmark index.